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Vertical Coordination in Agriculture

By Ronald L. Mighell and
Lawrence A. Jones
Economic Research Service

U.S. DEPARTMENT OF AGRICULTURE
Economic Research Service
Farm Economics Division

Agricultural Economic Report No. 19
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FOREWORD

American agriculture is in a period of rapid change. Most observers are well aware of the progress in technology and its influence on farming. Many are less conscious of the companion changes in the organizational structure of agriculture. The economic mechanisms which govern the working relationships between farmers and businessmen are reflected in a great variety of formal and informal arrangements. Many of these arrangements are of long standing and are so traditional as to arouse little comment. But others have arisen recently and are less familiar. They sometimes entail adjustments that lead to controversy and apprehension as to their ultimate effect. Some instances of contract production and vertical integration are in this class.

This study is a product of the Pioneering Research Group in the Farm Economics Division, one of a number of such groups and laboratories established within the Department of Agriculture in the last few years. Renewed recognition of the need for emphasis in fundamental research and provision to expand its scope was crystallized by Dr. Byron T. Shaw in a memorandum dated May 17, 1957, in which, as Administrator of the Agricultural Research Service, he defined and authorized the establishment of Pioneering Research groups and laboratories. The memorandum read in part: Pioneering research . . . "is not aimed at specific practical problems or objectives, but rather at the advancement of science . . . Such research will be undertaken to discover the principles underlying research areas and to develop theory which will greatly facilitate problem research as needs arise."

In line with this general aim the present study attempts to build a more balanced image of production and market structure that will lead toward the solution of economic problems associated with novel forms of coordination. The immediate objectives are to illuminate, to provide some unity of overlook, to indicate a basis for analysis, and to suggest lines for further research.

NATHAN M. KOFFSKY,
Administrator,
Economic Research Service.

PREFACE

Economic organization involves relationships between people and these are often more inflexible than those between people and things. The human tendency in interpersonal relationships is to be guided by the past and to cling to the well-tried forms and symbols. Misconceptions about new kinds of economic organization are therefore more prevalent than those about new kinds of technical organization.

This effort is addressed both to professional and nonprofessional readers who are interested in agriculture. It is hoped that it will be useful to economists, administrators, farm leaders, and others who wish to understand the basic forces determining the nature of vertical coordination in farming. If it helps us perceive the phenomena of vertical coordination as a whole and enables us to place new forms in balanced perspective it will have performed a service.

The writers acknowledge a many-sided indebtedness to a large number of economists who have contributed to the analysis. Only a few can be noted in this space. Raymond G. Bressler, Jr., University of California, and Glenn L. Johnson, Michigan State University, provided stimulating counsel in several seminar sessions near the outset of the study.

Others whose constructive criticism helped greatly from time to time include: Frank H. Maier, Marshall D. Harris, Gene L. Wunderlich, Walter G. Miller, Austin S. Fox, Fred L. Garlock, Norman J. Wall, Frank D. Hansing, Lee M. Day, Paul E. Nelson, Allen B. Paul, William T. Wesson, Arthur L. Domike, and Norman T. Zellner—all of the Economic Research Service. Orlin J. Scoville, Staff Economist Group of Agricultural Economics, furnished early inspiration and guidance. Kelsey B. Gardner, Homer J. Preston, and John M. Bailey, Farmer Cooperative Service, read the manuscript and offered suggestions about the role of farmer cooperatives in vertical coordination. John C. O'Byrne and Dean T. Massey, Agricultural Law Center, State University of Iowa, gave us the benefit of the legal mind. Gardiner C. Means, free-lance economist, gave sage counsel and shared some views from his background in industrial coordination. Carl P. Heisig, Ernst H. Wiecking, M. L. Upchurch, and Kenneth L. Bachman, Economic Research Service, whose professional and administrative insight provided a working environment conducive to pioneering research, have been helpful at all times. Finally, special credit is due Jack R. Davidson, our colleague in Pioneering Research, for his cogent suggestions on general arrangement and for his extensive reworking of Chapter 3.

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SUMMARY

The succession of stages through which a commodity passes on its way through the production and marketing process is familiar. Vertical coordination includes all the ways in which these stages are directed and fitted together.

Coordination of stages is both internal and external to the firm. Internal coordination is managed through administrative action within the firm. External coordination is accomplished through the action of prices, markets, and other forces that govern relationships between firms. As defined in this report, vertical integration is another name for internal coordination of stages. It does not include contract production which with open production constitute external coordination.

In open production, marketing commitments are mainly kept open until production is completed. For example, the farmer grows and harvests a crop of soybeans and then arranges to market it. In contract production, at least some of the significant market commitments are made before production is undertaken. For example, the grower of peas contracts with the pea processor to grow a certain number of acres of peas under specified conditions with a certain price formula.

Contract production sometimes approaches a degree of administrative control that is similar to that in vertical integration. A convenient three-way classification for production contracts is that of market-specification contracts, production-management contracts, and resource-providing contracts. This grouping classifies contracts in

accordance with the number of stages transferred from their traditional place with the farmer to the control of another firm.

Opportunities for profitable changes in vertical coordination are continually developing as production and marketing conditions change. New technology or new consumer demand may begin a new chain of events that will result in a new kind of vertical coordination.

Much the same economic theory that aids a firm in determining the most efficient scale of operation, also helps in choosing the most efficient number of stages. An additional problem in attaining the most profitable overall level of operation is that of harmonizing stages, each of which has a different optimum level.

The search for market advantage is another economic motive for changes in vertical coordination. Perishable products grown in limited geographic areas sometimes offer a basis for the exercise of market advantage that may be reinforced through changes in vertical coordination.

The long-time trend in American agriculture has been toward greater specialization in fewer commodities and in fewer stages in the production of each commodity. This has led to increases in some kinds of uncertainty with a corresponding need for offsetting devices. Cooperation, contracting, crop insurance, and various coordinating devices have been evolved to meet this and other needs.

Each kind of vertical coordination has special characteristics that

may help in financing farm resources in particular situations. For example, contractor financing of broilers seems to have advantages over conventional lender financing. Vertical integration may be the best way to obtain adequate investment in instances in which heavy or specialized investment is required. Integration of production with processing in shade-grown wrapper tobacco is one example.

The proportion of farm output produced under vertical integration or contracting with nonfarm businesses varies greatly between commodities. For some commodities there is little; for others it is nearly 100 percent. Commodities with high percentages include broilers, fluid milk, sugar beets, seed crops, and processing crops. Commodities with low percentages include corn, wheat, cotton, cattle, and hogs.

Contractual arrangements such as those in sugar crops, processing

crops, and fluid milk are of long standing and relatively stabilized. Integration and contracting trends in poultry and livestock are still evolving. Further changes will depend greatly on what happens in new technology.

Several significant areas of needed research in problems of vertical coordination in agriculture are apparent. More complete description and measurement of existing vertical coordination is an initial need. Analysis of the effects of particular kinds of vertical coordination should not be neglected. Closer examination of barriers and obstacles to desirable adjustments in vertical coordination will help in devising more efficient coordination. Exploration of relationships between vertical coordination and supply management will lead to better choices among alternative economic systems.

VERTICAL COORDINATION IN AGRICULTURE

By Ronald L. Mighell and Lawrence A. Jones, Agricultural Economists, Farm Economics Division, Economic Research Service, United States Department of Agriculture

CHAPTER 1.—INTRODUCTION

This is a report on vertical coordination of production but its concern is mainly with vertical coordination in agriculture and especially between farms and the businesses that serve farms. It is an exploratory analysis, not a final word. One way of approaching the subject would be to deal first with particular instances of vertical coordination, then to generalize from them. Another way would be to try first to bring together a body of general principles that bear on the economics of the subject, to use these principles to interpret existing information, and then to point toward the further research needed. The second way was adopted for this report.

What role can analyses of vertical coordination play in economic life? First of all they increase understanding so that farmers and businessmen can make more rational choices between alternative means of achieving coordination.¹ Except in the favorable circumstances of a new industry, it is often more difficult for economic innovations than for technical ones to gain understanding and acceptance on the basis of their real merits. Eco-

nomic innovations frequently conflict with established habits, customs, and institutions. A new hybrid seed that produces 20 percent more per acre is readily accepted, but a new method of business that carries the same relative advantage may involve institutional changes that arouse emotions. Any shift from customary channels of supply, marketing, and financing will impinge upon the economic status of many firms. Their operators are likely to regard any such change as an encroachment on their independence. They may think this even though the changes will benefit them. If economic analysis increases understanding of what is really involved in institutional changes, it will have made a significant contribution.

A second contribution from economic analysis lies in the identification of the problems that arise in connection with changes in vertical coordination. Examples of these problems are the ways in which new forms of coordination may speed up adoption of technology, create temporary pools of unemployment, shift management responsibilities, and affect farmers' prices and incomes. From such analysis will come evaluation of relative orders of importance, tentative diagnoses for testing, and plans for further research studies needed for positive contributions to efficiency and development.

¹ "Vertical coordination" is the general term that includes all the ways of harmonizing the vertical stages of production and marketing. The market-price system, vertical integration, contracting, and cooperation singly or in combination are some of the alternative means of coordination.

Interest in vertical coordination has been stimulated in recent years by the dramatic development and rapid expansion in production of commercial broilers. In this phenomenon, both economic and technical innovations have pushed a new industry far beyond old boundaries.

The growing interrelationships between agriculture and business have been noted by many. John H. Davis, who coined the term "agribusiness" to cover the complex of interrelationships between farming and business, has described his ideas in several publications and with his co-worker, Ray Goldberg, in a book (21).² As Davis puts it, "the term agribusiness encompasses today roughly the same scope of functions included under the term agriculture before the intrusion of technology" (20).

Several years ago, D. Howard Doane wrote a book dealing with what he termed vertical farm diversification, in which he set forth the advantages to a farmer of processing and marketing his own products directly to the consumer (22). In this kind of vertical coordination, the farmer seeks to control the stages of production beyond the farm.

The farmer cooperative is also an instrument by means of which farmers can exercise joint control over production and marketing stages preceding or following production on the farm. This might be said to constitute another important kind of vertical coordination.

More often, the image of vertical coordination is that of a nonfarm business taking over important management functions hitherto under the control of the traditional farm firm itself. The present writers have participated in a number of conferences in which the specter of dominance by nonfarm businesses has

hovered over the group and colored much of the discussion. But the fears expressed on this score seem to be inversely correlated with the distance from the actual situations in which the relationships are in operation. Those who are closely involved in contract production are much less concerned than those who are more remotely situated. Part of the expressed concern comes from representatives of farm organizations, market groups, and the banking system rather than from farmers. These established institutions are concerned about the adjustments that may be necessary in their own activities as a result of new institutions. But experience in areas where the adjustments have been made show these to be no more difficult to make than others associated with general progress.

Recent analysis in the U.S. Department of Agriculture on vertical coordination in farming dates from work of an interagency committee set up in 1958 to prepare a summary report on the subject. The report was published as United States Department of Agriculture Agriculture Information Bulletin 198 (60). A bibliography covering available information in the field was published about the same time (39).

Other analyses by the Department and in cooperation with the States, include a number of commodity studies on eggs, commercial broilers, sugar beets, processing crops, and other commodities. Some of these studies were made earlier; they were focused mainly on other objectives but included segments on contract farming and vertical integration (5, 7, 26, 27, 33, and 45).

The present report was prepared by the Pioneering Research Group in the Farm Economics Division, Economic Research Service. This small group was set up in 1959 in the then Farm Economics Research Division, Agricultural Research Service. This is one of a number

² Italic numbers in parentheses refer to Literature Cited, page 88

of pioneering research laboratories initiated in the Agricultural Research Service with the purpose of putting more emphasis on basic research. Most of the pioneering research groups so far established are in the

physical and biological sciences. A somewhat similar basic research unit in marketing economics has been established in the Marketing Economics Division, Economic Research Service.

CHAPTER 2.—CONCEPTS AND DEFINITIONS

We are concerned here with the vertical arrangement of the production process. The term "vertical" is the conventional one for the direction taken by the succession of stages in production leading from primary raw materials toward a finished product or service ready for consumption.³ "Horizontal" is customarily used to refer to the replication of units at the same stage of production.

In the broad economic sense, "production" is any activity that results in the creation of form, space, or time utilities. The ultimate utilities are the goods and services that are finally consumed by people. Bread and music are both economic goods, even though bread is more tangible. All of the steps along the way from the most remote raw materials to the final consumer goods or service may be thought of as production stages in the total production process. Before bread is possible, wheatland must be prepared and seeded and the wheat grown and harvested. The harvested grain must be stored, transported, and milled into flour. The flour must be moved to a bakery and combined with other ingredients in the baking process, and the bread must be transported and sold at retail. The broad line of stages through which the tangible

product moves is clear. But the many collateral lines of stages that converge and flow into the main line are not always so evident. Each of the inputs brought into a stage has its own subsidiary line of development with its stages. Think for example of what is involved in the production of fertilizer, farm machinery, and other supplies and services used in wheat production, or of various lines of activity that center on the bakery where the bread is baked.

Or consider the music that comes from your FM radio. You can imagine the long production chain that leads to the radio itself. But think for a moment of the music you hear. Your receiving set would be of no use without a radio transmitting station with its organization of specialists for handling the technical stages of reproduction and transmission. Suppose you are listening to a live orchestra playing Beethoven's Fifth Symphony. Here again is a complex organization for producing an ephemeral service with a chain of antecedent stages stretching back to the composer Beethoven himself, not to mention the original makers of the instruments the musicians are playing and the training and rehearsals that are essential parts of the total production process.

In primitive societies nearly all of the vertical stages in production are combined in self-sufficient firms. But even there a few products exhibit separate vertical stages, if for no other reason than separation in space and the need for transportation. Salt is an example of such a

³ The vertical arrangement of production stages is variously referred to by different analysts as leading up from raw materials, as proceeding from left to right, or as coming down from above. This differing geometric orientation accounts for the apparent anomaly of such expressions as backward and forward vertical integration.

commodity. It is refined near its origin in a few places and moved long distances.

In technologically advanced societies, reasons for vertical separation of stages are numerous. New stages and new means for the division of old stages are continually arising. Any new technical development may raise a question as to whether it can be better exploited by existing firms or in separate new firms. For example, one of the authors of this report recently received a letter from his local automobile dealer reminding him that his car is due for servicing. The dealer did not send this notice himself, even though his facsimile signature appears on it. Rather he arranges with a commercial mailing agency to circularize his customers at regular intervals. The mailing service is an independent business that performs this function for many small and moderate sized businesses.

As your physician makes his out-of-office rounds, he may carry in his coat pocket a small radio receiving set not much larger than a clinical thermometer. Occasionally, he holds it to his ear and listens for his call number, which is broadcast repeatedly at intervals if his office wants him for an emergency. If he hears his number, he goes to a phone and calls in. All of this is part of a contract with a specialized radio calling service which caters to doctors' special needs.

These are isolated examples, but a little reflection will remind us of many situations in which something economically similar takes place. The basic reason for specialized performance of such vertical tasks by separate firms is that they can do it more economically. By selling to many customers, a specialized firm can attain a scale and efficiency of operation that would not be possible for each customer to attain in his own business. The services performed by insurance companies,

transportation agencies, storage companies, banks, and many others are like this.

Sometimes the minimum economic scale of operation for a given stage is so large that it could not be supported by any one of the business firms that use it. Very few dairy farms are large enough to handle their own artificial insemination program; few vegetable growers are large enough to do their own airplane dusting.

The Concept of the Firm

The concept of the firm is deeply imbedded in economic theory and analysis. Classical economics did not overlook the firm, but it took Alfred Marshall and his use of the representative firm to give the concept a focal place in economic thinking.

Since Marshall's time, two divergent lines of conceptual development in the theory of the firm can be noted. One line is a further evolution of Marshall's model as an aid in one of the central problems of economics, the explanation of price determination and resource allocation. This equilibrium model has been a highly useful device in general economic theory. The other line is the use of the concept of the firm as an organizational model in connection with solving problems of the operating firm. Analysts who deal with prices and markets have been building the theory needed to explain the broad structure of the economy external to the firm and its relation to price and value determination. Those who deal with business management and farm management have been building the theory of internal structure and administration of the firm. Some persons have thought that the internal problems of the firm are mainly technical. While it is true that many technical considerations are involved, the economic choices involved in organ-

izing and managing a firm are fully as much the business of the economist as are those relating to markets and prices.

Before we consider theory we must be more familiar with certain terms. We have used the terms "economic firm," "stage," and others without attempting close definition. The production of any economic good or service does not go on by itself. Arrangements must be made for supplies and materials to be brought together and for operations to be planned and carried out. The unit of organization that does this is called a *firm*. Because the various functions that a firm performs, such as planning, decision making, risk taking, owning, renting, and the like, can be divided and parcelled out in various ways to other firms, there has been much discussion about the basic constitution of the firm.

The firm has been defined variously. For example, Boulding says that an economic firm is an economic organism that buys inputs, performs operations on them, and sells the results with the expectation of making a profit (10, p. 491). Penrose sees the firm as essentially a pool of resources, the utilization of which is organized within an administrative framework (49, p. 24).

Each analyst's definition is designed with a specific purpose in mind, it may not be fully appropriate for other uses. Boulding is thinking primarily of profit seeking in the business world. He recognizes that there are other economic organisms that are organized for other purposes than profit. For example, a wage earner, a car pool, a hospital, or a country club would be considered economic organisms in his terminology. The Penrose definition is designed for use in studying the growth of firms and is somewhat less restrictive than Boulding's.

For the purpose of analyzing vertical coordination, an *economic firm* is defined as any separate economic organization that has for its purpose the production of economic goods or services. This permits the inclusion of organizations that produce not for profit but as a service or convenience to members or clients.

What a firm does in carrying on production may be described in several ways. One can reduce the various tasks performed to a generalized classification that will apply broadly to any type of production. Thus we speak of financial management, technical supervision, organizing and planning, buying and selling, risk-bearing, and the like. These are generalized functions, and classification on this basis might be termed functional. C. L. Holmes considered that these functions could be grouped under the headings *organization*, and *management* (32). These terms correspond roughly with what the military specialists call *strategy* and *tactics*, in which strategy lays out the broad campaign and tactics deals with the immediate management of battles as they take place.

The essential entrepreneurial function performed by the firm as a separate entity is the controlling or decision-making function. Control of policy decisions constitutes the administrative core of the firm. For each decision there is a risk, so the responsibility of risk-taking is an inevitable corollary of decision making under the conditions of uncertainty that characterize the world around us. Yet even decision-making and risk-taking can be bought and sold in large part, and to the extent that a firm can improve its position by so doing, it will buy or sell these services so far as the economic motive is the governing criterion.

Another way of describing what a firm does is to list the specific tasks performed in producing a par-

ticular product or service. If these are arrayed in the approximate chronological order of occurrence, we have the familiar vertical steps or stages mentioned earlier. Each step can be fitted into one or more generalized functional classes. The specific step forms a particular operating process. For example, crop spraying and dusting may be considered under technical management, and crop insurance may be placed under the risk-taking function.

The specific tasks have been called steps, processes, or stages. These are synonymous terms and may be used more or less interchangeably depending upon the shade of emphasis desired. In this report, the term "stage" is ordinarily used. This term is sometimes interpreted solely as a physical concept, but the *stage* used here is an economic stage. It is economic because it represents an organized process in which several factors of production are appropriately combined for the purpose of production. Given a set of technical conditions, economic choices influence the proportionate combination of these input factors.

As a working definition, we shall consider that an *economic stage* in production is any operating process capable of producing a salable product or service under appropriate circumstances. Such a process may be a part of a longer production sequence within a firm so that no sale of the intermediate products occurs. But so long as there is the possibility of separate sale under other circumstances in which the sequence of stages may be divided between firms, each process may be considered as a separate stage. Thus the hay enterprise on a feed-livestock farm may be regarded as a stage, even though all the hay is fed on the farm where it is grown. Again, if the harvesting done by a custom combine is recognized as a stage, then the harvesting done by

the farmer with his own equipment must also be a stage. On the other hand the term "stage" is used flexibly so that several minor stages may be treated together as one major stage if it suits convenience. Goods and services in themselves are not stages; they are the end results of the stages that provide the organizational framework for their production.

Economic stages are thus separated from one another by what happens or what might happen. The demarcation points are not unlike what John R. Commons would have called transaction points (48). In Commons' view, transactions were the economic actions taken by businessmen in bargaining, managing, or rationing. Commons' thinking centered more especially on the analysis of social relationships and the economic behavior that interested him was that which took place between human beings. His concept of transactions might therefore have excluded intrafirm decisions with respect to stages or processes that involved mainly physical relationships.

A stage as we define it is an organized process that is potentially capable of becoming a firm under appropriate circumstances. Firms may consist of many vertical stages or of only a single vertical stage. The smallest stage that can be conceived is one that produces the smallest unit of utility that is potentially salable. This may be a separate product or service, or an additional utility added to some existing product or service. A graphic representation has been suggested by Blaich in terms of a 2-way product grid as in figure 1 (8).

The horizontal axis represents units of product (for example, bushels of corn), and the vertical axis represents units of utility added at each production stage as the product moves vertically toward a final consumer good. The horizontal

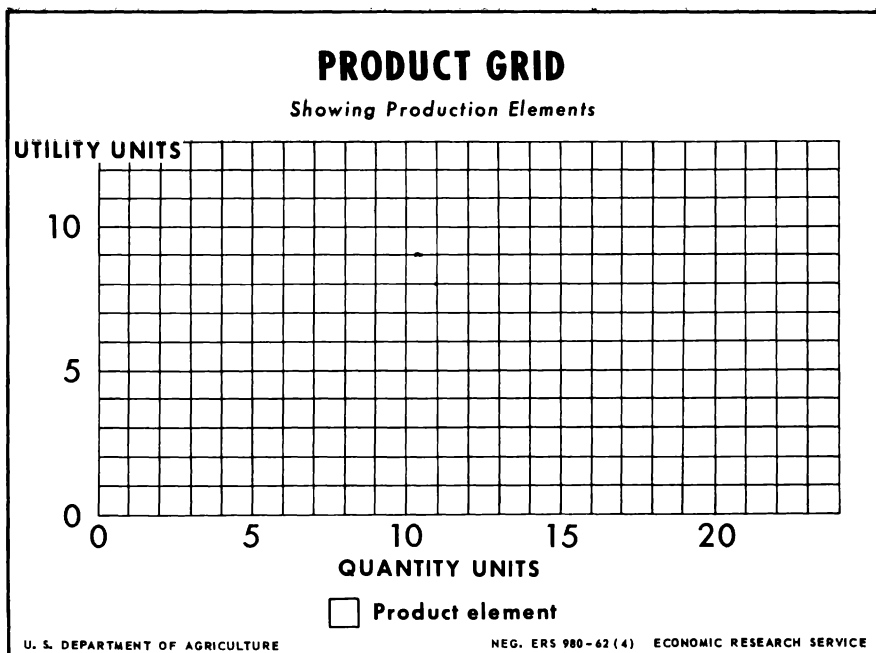


FIGURE 1.—A total product-grid delineated to show the concept of the product-element.

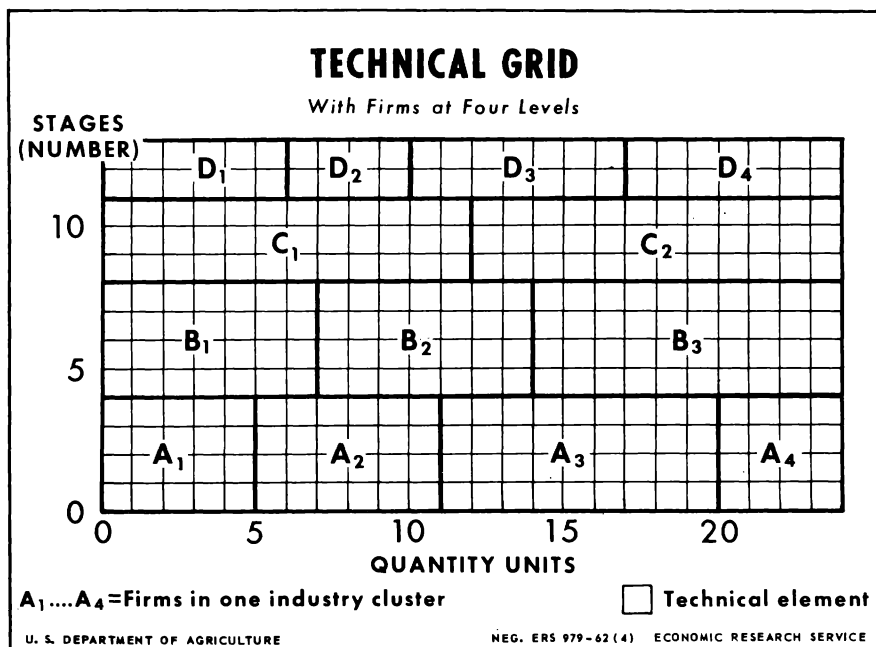


FIGURE 2.—A total technical-grid delineated to show the technical-elements, the structure of firms, and the industry cluster of firms.

axis presents few difficulties, because production is measured in the familiar units of output that economists are accustomed to handling with the usual methods of marginal analysis. But the vertical axis presents more problems. Blauch's suggestion is to use a similar marginal analysis in the vertical dimension as an alternative line of expansion. This is hopeful, although as utility is difficult to measure, the means are likely to prove more complex.

The product-elements, represented by the small squares in the grid can be translated into their underlying technical-element counterparts and can be combined in various ways and organized into firms. The technical-elements are the building blocks that make up the cost structure of each firm (fig. 2). The number of stages and the number of horizontal units at each stage to include in a particular firm will depend upon the technical efficiency and capacity of the firm in the circumstances. The firm can extend itself either horizontally or vertically; it will eventually encounter increasing costs in either direction as its fixed resources are more fully utilized. Once having attained an equilibrium, any new change in technology or demand would call for further regrouping and restructuring.

Not all utilities are produced in the strict chronological order suggested by the simple vertical concept. Of the three principal kinds of utility—form, time, and place—the vertical concept fits best with *form* utility. For example, think of the changes in form undergone by the tree felled in the forest as it goes through the many stages necessary to become the chair in your living room. Many things occur to change the form of the tree as it becomes successively a log, a rough board, a planed board, specified chair segments, and so on. But some of the utilities added are less definitely tied to form and are thus

more difficult to place in the vertical chronology. In fact, they spread over the obvious physical changes almost as though they were in another dimension. Such services as insurance, accounting, banking, market information, and advertising play a part in adding utilities to the final product. Frequently, each is handled by an independent firm. To be consistent with the broad definition of economic stage given above, these indirect but less tangible stages, as well as the more direct and obvious ones, must be recognized. Each activity that produces a potentially salable utility, or set of utilities is a stage.

How can we modify the simple linear concept of vertical coordination to represent the content of stages more fully? One way would be to think of the production process in terms of a multiplicity of converging lines of stages, a fan-shaped flow leading to a final product. In terms of farm analysis, one could think of the stages leading to the provision for each major input item. For example, the stages resulting in the seed, the fertilizer, the machines, the insurance, the banking services, and so on, could each be represented by a line converging on the next product.

Another way of envisioning the whole process is in terms of an assembly line. In a modern automobile plant, cars are put together on a line that moves each vehicle from station to station as it progresses. Each station is a minor assembly point for the addition of one or more items. The assembly line is the eye-catching part of this process, but the less spectacular and less visible supply lines that feed assembly stations are even more significant. So it is with many economic processes. It will be evident as we proceed that in real economic life, the orderly patterns suggested by such comparisons do not always appear. Vertical stages are sometimes instantaneous,

continuous, intermittent, contemporaneous, or in a variety of configurations, as well as in neatly ordered lines of succession. The image of chronological vertical succession is only a general symbol to aid our thinking; it should not be taken too literally.

Interstage Relationships

We may use the term "vertical coordination" to include all the ways in which the vertical stages of production are controlled and directed. This leads to an obvious dichotomy of integrated and non-integrated kinds of coordination. Coordination of stages takes place both within and between firms. Internal coordination is controlled by the firm's own administrative structure; external coordination is carried on between firms through the functioning of the pricing system and the market structure.

In a broad view, integration (either vertical or horizontal) is brought about by the same forces of industrial evolution that lead to specialization. In fact, one can regard economic change and progress as achieved through the continued joint working and interaction of specialization and integration.⁴ The adoption of any new item of technology, any improved practice, disturbs the existing equilibrium of economic forces and leads to a different pattern of vertical and horizontal integration. The invention and general adoption of the small combine-harvester, for example, meant that for many farmers the harvesting stage for wheat could be more completely integrated with the farm than before. The coming of hybrid corn, however, meant that production of seed corn was henceforth separated from the farm and integrated into a few large specialized seed-corn businesses. Changes

in the tax laws and other institutional factors may also modify the pattern of coordination.

Vertical integration is the term applied to the vertical structure associated with internal coordination; it consists of two or more stages of production joined together in one firm.⁵ Of course, no economic system is completely integrated or completely nonintegrated. Integrated firms come in contact with other firms and consumers through the markets in which they buy resources or sell products. Firms that are considered nonintegrated usually have at least some integrated stages. The production grid in figure 2 is an illustration.⁶

But what constitutes control by one firm? Production under advance sales contracts is commonly referred to as a form of vertical integration on the ground that a business firm is able to exert some control over other firms through a contract. The authors of this report have sometimes taken this view. But continued reflection has led to the belief that a different interpretation is more useful and will lead to greater clarity of thought. Therefore, the term "vertical integration" is reserved for those situations in which a single firm has taken over the administrative operation of two or more stages of production.

⁵ Vertical integration is sometimes thought of in terms of change from some preceding situation, without thinking about the extent of integration already existing in that situation. Thus a merger of two complementary firms or an increase in the number of stages through growth may be referred to as vertical integration.

⁶ For some purposes, it may be necessary to distinguish between *administrative control* and *administrative allocation* of resources. Administrative allocation presupposes administrative control, but administrative control may also be used with market allocation of resources. Thus a crop and livestock farmer may raise part of the feed consumed or more than is consumed and buy or sell feed to balance.

⁴ See discussion of the point in the paper by Raphael Trifon (58).

We have thus two major ways of achieving vertical coordination of a number of stages. In the first way, a single firm transfers resources between stages through internal administration; in the second, a number of firms transfer resources through prices and related means in the market. Each of these two major categories can be subdivided in various ways for different purposes. For example, vertically integrated firms may be highly centralized, loosely federated, or otherwise joined with various degrees of autonomy existing between the vertical and horizontal divisions within the firm.

Nonintegrated systems also may be subdivided into classes in accordance with the structural arrangements for achieving vertical coordination. The separation that most interests us relates to the timing of the marketing arrangements between firms operating at different stages. Are the contracts between these firms made before production is undertaken or are arrangements for sales between stages made after production is complete? In either instance, coordination is accomplished through a market, but the difference in timing is important. The advance contract method is sometimes called *forward contracting* or *contract production*. The method in which no advance agreements are involved is often called *open production*.

How coordination takes place under open production may be easier to understand if we first consider contract production. Contract production is widespread and varied. A forward market may be as competitive as any other kind of market. Certainly in many situations, it is a more competitive market than any other that could be devised. But it may also be less competitive.

Contracts for construction work of many kinds—highways, bridges, office buildings, private homes, and

all sorts of permanent equipment—are well known. Contracts for construction of component parts of automobiles and other machines are routine. Contracts for all kinds of services in the business world have been used for so long and are so common that we almost forget them. Benjamin Franklin held government printing contracts before he retired at an early age to devote his time to other public objectives.

When we buy season seats for the theater or football games we are dealing in a forward retail market. Reservation for space on a Pullman or an air liner are other examples. The college student who pays his tuition and fees at the beginning of the semester is contracting for future production. When we subscribe to a magazine or join a book club, we are doing the same thing. In fact, any commitment for the future delivery of goods or services involves relationships of this general nature.⁷

Contract Production and Forward Markets

Contract production is production for a forward market. A forward market is one in which transactions have to do with goods and services to be delivered at a later time. Production contracts are made between independent firms. The relationship between the contracting firms during the time the production processes are going on seems closer than in open production, because significant market commitments are known for at least one production period. Such ties have led some observers to believe that control over production operations in some measure approaches the control that exists in vertical integration. This impression is especially likely to arise when the

⁷ For further development see the careful exposition of forward selling by Harold B. Rowe in the 1954 Yearbook of Agriculture (52).

number of specifications for the products or services are numerous. In this situation there is often considerable overlapping and intermingling of the stages performed by these firms. For example, firm B₁ in figure 3 has a contract with firm A₁ under which it has undertaken to perform certain stages that traditionally have been in the hands of A₁. The crosshatching indicates a temporary overlapping of part of A₁. On the other side, A₄ contracts with B₃ and reaches forward into stages traditionally belonging to B₃.

Production contracts are essentially similar in calling for the performance of sets of specified processes that will add utilities to the products produced. They differ chiefly in the number of processes assumed by each party to the contract and in the complexity of relationships between the parties.

But to say that a larger collection of specifications or a greater overlapping of processes necessarily means a higher degree of control or integration may misinterpret the situation. What often happens is that particular stages or processes are transferred from one firm to another, so that the total number of stages controlled by each firm changes. But the extent of control by each firm over the stages remaining in its hands may be quite unaltered. Moreover, the horizontal expansion that becomes possible may greatly enlarge the scale of operation and lead to significant economies.

Most contract production appears to be of the kind that can be called independent contracting or contracting between independent contractors. The significant differences between different types of contracts lie in the extent to which specified processes or stages in

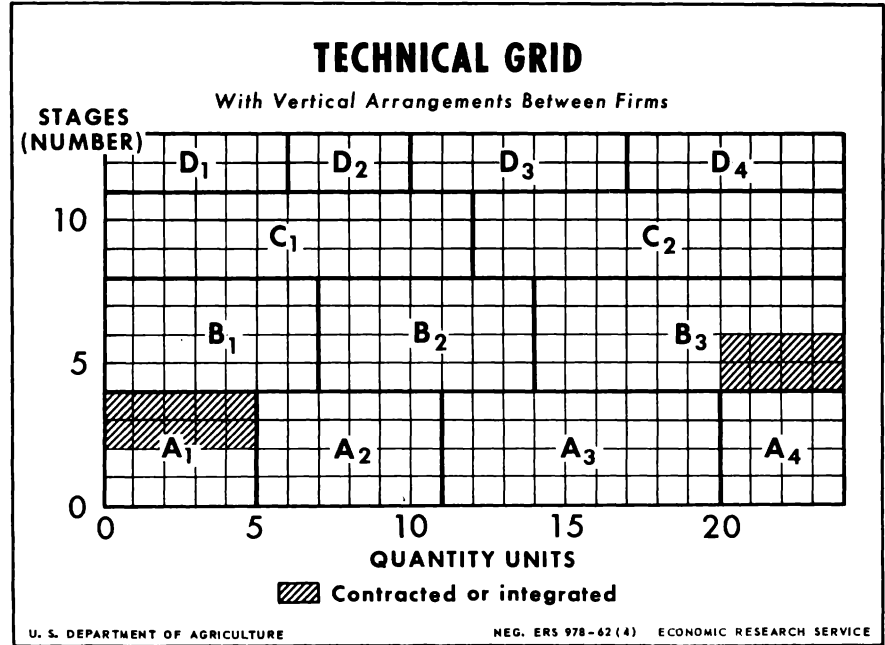


FIGURE 3.—A total technical-grid drawn to show vertical overlapping of stages traditionally belonging to separate firms.

production are transferred between the parties.

One might say that contract production is an orderly way of redistributing the stages that are to be vertically integrated in one firm or the other. The vertical integration occurs between stages rather than between firms, and this is a point that has led to confusion. The term *interfirm integration*, for example, suggests an integration between firms, but ordinarily contracting leads to different patterns of *interstage* integration rather than to *interfirm* integration.

Vertical and interfirm integration would arise if a complete merger between two vertical firms occurred. Or it would arise in those instances of contracting in which elements of joint venture, partnership, or co-operation between two adjacent vertical firms became so dominant as to result in a joint operation for one or more production periods. Such an arrangement might better be treated as a temporary merger and the enterprise as a single firm. Landlord-tenant livestock-share leases, and certain other share arrangements can be so regarded.

Classification of Production Contracts

As indicated above, contracts vary greatly in number of stages or processes that are transferred from one firm to another. In some instances, the transferred stages are so few that the situation differs little from open production. In others, so many stages are involved that for the duration of the contract the operation approaches that of a single integrated firm. It would be useful to have an orderly classification system in which to place contracts as they fall between open production at one end and complete vertical integration at the other end of this continuum.

The analytical mind recognizes the two polar concepts of independ-

ent competing firms and complete integration. Then it seems to search instinctively for a classification scheme that will reflect the degree of integration between these limits. For example, O. P. Blauch in correspondence with the writers of this report wrote: "I feel that the degree of integration is a function of the number of decisions that are undertaken in stage A by the management of stage B." But if the shift from A to B of decision-making substages enables the A firm to expand horizontally to include a greater total scope of economic activity than in its traditional state, the suggested measure does not really measure the significance of the area under independent operation.

The basic difficulty seems to lie in the attempt to impose a unidimensional scheme of classification on a multidimensional situation. This may help explain why so many special groupings have been devised to describe alternative ways of coordination for different commodities. Probably no scheme of classification can be devised that will serve to reflect degree of integration in a situation of this complexity. But for some purposes it may help to classify contracts in groups in accordance with the number of functional stages, or parts of them, that are transferred from the traditional operation to another firm through contractual arrangements. A fairly common grouping would be represented by a three-way division into market-specification contracts, production-management contracts, and resource-providing contracts.

Market-Specification Contracts.—

In market-specification contracts, the producer transfers parts of the risk and management function to the contractor. The producer becomes more certain of his market for at least one production period and the price, or the basis for computing the price, is stated. The management

function transferred is limited to that part related to the decisions as to what shall be produced and as to when and where it is to be marketed. But the number of the functions transferred is small relative to the number remaining in the farm firm. The firm continues to make production operating decisions, provides and finances inputs, assumes the uncertainties of production. A farmer who grows cucumbers under contract to a pickle factory is an example of this class. A dairyman who produces milk under contract to a fluid milk distributor is another.

Production-Management Contracts.—Production-management contracts are like market-specification contracts but call for more direct participation by the contractor in production management. This management usually takes the form of cultural and resource specifications and field inspections during the production period. It is important when quality of output is important to the buyer. Management assistance may be especially needed when new technology or new producers are involved. Production-management contracts occur in such commodities as eggs, tomatoes, sweet corn, and sugar beets. In sugar beets, for example, the sugar company may specify seed variety, fertilizer analysis, water use, land rotation practices, and harvest and delivery dates.

Resource-Providing Contracts.—In resource-providing contracts, the contractor not only furnishes a market and participates in production management; he also provides important inputs. For instance, broiler producers relinquish to the contractor the function of providing most of the operating resources, such as chicks, feed, and medicine. The contractor owns the commodity produced and is responsible for its sale. The producer is paid on the basis of volume of output—so much

per pound of broiler, per egg, or per pound of hog. The contractor assumes the additional risk of losing his investment inputs. Because of this, he usually controls production closely and claims most of any profits. Thus, in terms of the number of stages or functions that the traditional farm firm transfers to the processing or marketing firm, this kind of coordination is next to complete vertical integration. In a few of these contracts in which the producer is paid a salary for producing broilers or eggs, he transfers most entrepreneurial functions to the contractor.

The boundaries of these groups are not precise. It may be difficult to decide where to place a particular contract. For instance, the production specifications of some contracts may become so detailed and demanding that at some point they may pass from market-specification group to the production-management group. Similarly, the provision of inputs by the contractor may be so minor, say for seeds, that the contract could be considered a production-management contract. But as inputs assumed by the contractor increase in number and importance, the contract eventually falls in the resource-providing group. The main purpose of such a suggested classification system is to recognize the major differences between contracts with respect to the number of the traditional functions transferred.

The three-way grouping suggested above is convenient for some purposes. However, it needs to be recognized that strategic control virtually equivalent to control under vertical integration may be achieved under any of the groups. For example, a fluid milk distributor may exercise greater control through a market-specification contract than a sugarbeet factory does through a production-management contract.

Open Production and Later Markets

Open production is production for a later market, one that comes after the production has been completed. Open production is open in the sense that the producing firm is in an open position with respect to disposal of the product. It is not committed to any specific market outlet nor is it protected against the uncertainties that may arise from this lack of commitment. In the building industry, for example, a house may be built to order under a contract, or it may be built to sell on the open real estate market after completion.

Persons or firms who operate in the area of open production are sometimes said to be speculating in the commodity undergoing production. This is true to the extent that they are assuming the risks that might be covered by advance contracts. Examples are those involved in the separate fluctuations of the prices of houses in the real estate market and those for labor, lumber, and other resources used in the construction of houses. Farmers who produce crops and live-stock for sale in spot cash markets are also engaged in open production with the same kind of speculative natural and economic hazards. Contracting usually involves important elements of hedging against the various hazards that may occur during the time production is going on.

Bakken (6) considers that contract markets are a more advanced form of market than are open markets, but this may be debatable. It is uncertain which came first. One might suppose that barter trades must originally have been based on existing supplies of trade goods, for which open production would have taken place earlier, at least to the extent of accumulating surpluses above current consumption needs. Yet it

may well have happened at an equally early date that the village arrowsmith made a deal with one of the hunters to keep him supplied with arrows in exchange for a continuing supply of buffalo meat. This would have been contract production under barter. Perhaps contract production and open production have enjoyed coexistence for several milleniums.

In agriculture, some of the best-known markets deal in products resulting from open production. The central commodity markets are mainly such markets and many smaller local markets are related to them. However, one of the most highly organized markets, the futures market, deals only in contracts. In fact, almost any type of market can be used with either contract or open production. This will apply all the way from simple negotiation between two parties to the most highly organized forms of markets.

The choice between contract or open production may be influenced by custom, convenience, or special circumstances. Consider, for example, the production of a tailor or dressmaker. Before the present clothing industry was developed men's suits and women's dresses were either made at home or on order (contract). Few tailors or dressmakers could afford to carry an inventory of readymade items of clothing. No customer of the right size, in person or pocketbook, might come by in a long time. But with the development of low-cost mass-production factory methods in the clothing industry, the situation changed. Now clothing in a great range of current styles and standard sizes is available throughout the country. A few independent dressmakers and tailors still make things of unique design, or having special qualities, or in outsizes. Contract production makes possible the continuation of these special types of independent production.

In some service industries, a completely open production would not be possible because services are often attached uniquely to a particular location. The buyer and seller in such situations must reach agreement before production takes place. Suppose you enter a barber-shop for a haircut. If you are a stranger in the city, do not know the price schedule, and fail to inquire, you may presently object to the level of charges; however, it won't do much good after you have received the haircut. The service cannot be rejected and returned. Once you enter the barber's chair, you have passed the point of no return on a one-time contract job. In such situations, open production is not a real possibility.

Probably no economic system could operate entirely on the basis of either open or contract production. The uncertainties of both supply and demand conditions are too many. Reserve stocks and reserve capacities of various kinds are necessary in many areas to offset the unpredictables. With reserve stocks in existence at some points in the economy, some portion of production must come before open markets.

An example may suggest how often mixtures of both open and contract forms are found in combination. Large city newspapers are commonly sold through at least three markets—mail delivery by subscription, household delivery by carrier, and cash transaction on the street or at the newsstand. The first method is a forward contract with advance payment and deferred delivery; the second is a forward contract for deferred delivery with payment at the end of a production period; and the third is open production for a cash market. Each of these outlets contributes to the total circulation.

Another example may be drawn from the commercial broiler industry already cited as a prototype of

contract production. If the finished broilers are sold to processors through an auction market, as they are on the Delmarva peninsula and in several other areas, we must recognize that the broilers are the result of open production. But how can the same production be considered both contract and open production? This seems to be a puzzle until we realize that we are not referring to exactly the same stage relationships. Production of broilers for the broiler auction market is an open operation from the viewpoint of this market. The contracting relates to the tie between the broiler production and the provision for the supplies and services needed. It is the market for these inputs that constitutes a forward market.

In these examples, as in many others, we have a mixed system. Various stages of production are truly integrated; others in the vertical chain are clearly separated and operated by independent firms. The independent firms operate through forward markets and later spot markets under what we have termed contract and open production. The same product may be involved in many different types of arrangements as it moves vertically from the beginning to the end of the roundabout production process.

Both contract production and open production are forms of production for the market. Contract production is a device that sometimes makes possible a redivision of stages or processes between firms, so that different patterns of interstage integration may be achieved without the necessity for interfirm integration and the consequent merger and loss of identity of independent firms.

The Means of Vertical Coordination

As we have indicated, there must be some means of coordinating the

activities of the millions of individuals who participate in producing goods and services to satisfy the demands of consumers. Where production will take place, what methods will be used, how many producers there will be, what combination of resources will be used, and what forms of business organization there will be must be determined.

Traditionally, open-market prices have been important in guiding adjustments in production and distribution. Forces of supply and demand, working through incentives of profit and loss, are often assumed to result in the most efficient production of goods most wanted by consumers. But this result does not always follow because, as Collins and others have pointed out, prices as a set of signals for coordinating production at different stages in our complex mass-production system do not always communicate clearly the specifications desired (18). The open-market price system for some commodities doesn't work very well; it needs to be supplemented or replaced by other coordinating arrangements.

Government is increasingly called upon to regulate open-market transactions. Producing firms act to modify the coordinating forces of the open market. At times, they combine several vertical stages of production within a single firm and bypass certain open markets. Firms also coordinate their activities with other firms by negotiating agreements in advance of production. We are concerned mainly in the next few chapters with vertical integration and contractual arrangements in agriculture and why these forms of coordination have come about.

Firms integrate vertically for many reasons. Vertical integration is not an end in itself but a means, or tool, to accomplish some objective. It is a form of business

organization or a way of doing business. Whether vertical integration is used or not, who is the main initiator of the business, and the form that integration takes, depend upon the objective or problem at hand, upon production and marketing technologies, and upon the economic environment in which the firm operates. Sometimes no logical reason is obvious; particular business stages and firms may be integrated for no other reason than historical accident. Thus there is no single simple theory of why vertical integration occurs. To account adequately for integration in an industry such as agriculture or even in the production of one commodity involves many economic and noneconomic considerations.⁸

Reasons for contractual arrangements in production are similar to those for vertical integration. A contract is one way of achieving coordination in successive stages of production or marketing. For particular jobs, the contracting firms are joined closely, and sometimes they eventually become vertically integrated. Within vertically integrated firms, decisions are made administratively and transactions do not pass through an open market. Under contractual arrangements, many transfers also bypass a former market once agreement has been reached. Important differences between the two forms of coordination are that under contracts, arrangements are usually for limited duration and the number of actions and decisions involved are fewer. Firms under contract also maintain their separate identities. Whether vertical integration or a contract is employed often depends upon the capital resources of the initiator, the

⁸ We are concerned mainly with economic considerations in this study. But many noneconomic considerations influence individual decisions: Pride and prejudice, pomp and circumstance, custom and habit, religion and family, and accident and coincidence.

degree of production control he desires, and the competitiveness of the market he faces.

A listing of incentives for vertical integration or contracts might include: Reducing risk, reducing costs, improving management, gaining bargaining power, improving market position, assuring adequate inputs, investing surplus reserves, developing new technology, and obtaining additional capital. These are often interrelated. Several may be involved in one situation. In particular instances, it is difficult to determine the dominant objective and what are means and what are ends. Business strategies other than vertical integration or contracts may be involved in achieving the objectives. Horizontal expansion must often be employed if the vertical expansion is to accomplish its purpose.

Most decisions to integrate vertically (or to disintegrate) can be explained partly by the motivation for profits. The action is taken either to increase profits or to prevent losses. The focus on profits may be long- or short-run. The integration may be "economic" in the sense of being a cheaper or better way of doing a job. Or the objective may

be to gain profits by means of monopolistic activity, delaying adoption of improved techniques and methods, and putting consumers and competitors at a disadvantage.

At the farm level in agriculture, the economic reasons are usually the more significant, particularly those related to cost and efficiency. Among other economic reasons frequently cited for contracting or vertically integrating are the desires to offset risk and uncertainty, to obtain financing, and to introduce new methods. Uncertainties are of various kinds. For example, there are uncertainties with respect to market outlets and prices, technical control of quality, flow of perishable materials, and the like. Financing is bringing together resources in the proper quantities at the proper time and place to carry out a production process. The introduction of new methods can be an educational process that greatly speeds up learning.

The next four chapters examine in greater detail the theory of the firm and profit maximization, market structure, risk and uncertainty, and capital and financing as reasons for particular forms of vertical coordination.

CHAPTER 3.—ECONOMIC EFFICIENCY AND COORDINATION

The Efficiency Problem

An individual firm is efficient in a limited sense when it is able to achieve short-run profit maximization. This assumes the best possible use of resources within the limitations of the existing plant. However, to be efficient in a competitive environment in the longer run, a firm must be able to bring about organizational changes that will lower unit costs. Such changes must take account of both horizontal and vertical dimensions of the firm. The optimum size for each stage and the optimum number of stages are both essential to long-run efficiency.

For insight into the nature of the problems involved, we turn to formal economic theory and particularly to the guideposts to efficient organization of production set forth in the conventional theory of the firm. Conceptually, this model encompasses all the important dimensions of the efficiency problem. However, much of the effort of economists has been devoted to predicting and explaining the actions of a firm producing a single product and conceptually limited to a single economic stage.

Although the other aspects of achievement of efficiency have not escaped consideration, many of the important theoretical contributions receive only passing attention in most textbook treatments. The following discussion attempts to tie together some of these contributions. The procedure will be to build from simple to more complex situations. For those interested in

pursuing the theoretical aspects in greater detail, the footnotes provide further guides.

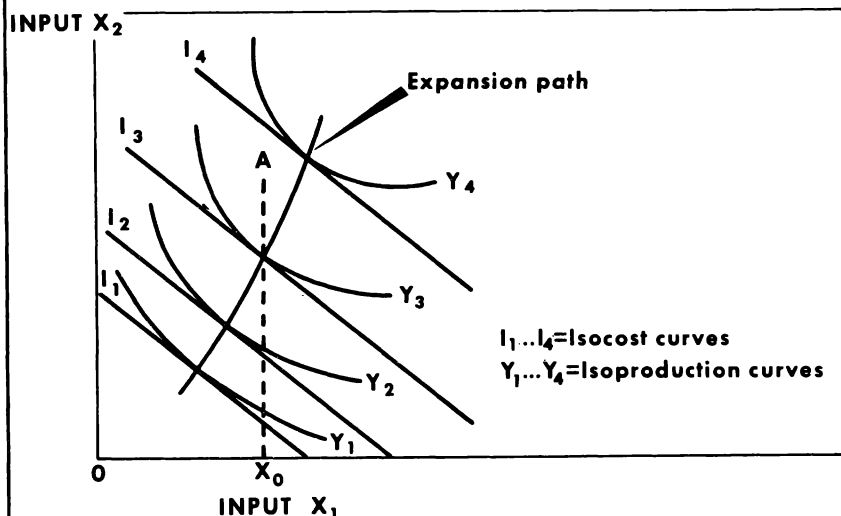
Short- and Long-Run Efficiency for a Single-Stage Firm

The Concept of a Firm's Plant

As the point of departure, let us limit the conceptual firm to a single economic stage and to the situation in which the firm plant consists of a given collection of fixed factors. Production at each stage may be viewed as a process which changes the product. Usually each stage utilizes different durable factors of production. The economic stage then may be defined as encompassing those production services—durable and nondurable—that cooperate in performing a minor operation or group of minor operations in creating a finished product. To the extent that the durable units are segmented into similar operating units they may be conceived as being installed in parallel (nondurable inputs need only pass through a single unit at any stage). The number and size of these units determine the scale of this economic stage.⁹

⁹ The cost function may be discontinuous if the stage contains parallel units of durable factors, such as identical machines. This does not make the problem of the short- or long-run optimum insoluble. However, it must be recognized that the condition that profits are maximized when marginal costs equal marginal revenue may no longer apply, when the cost function is discontinuous. See French, Sammet, and Bressler (*25*, pp 550–554). This follows material of Hans Brems (*11*).

FACTOR COST MINIMIZATION



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FIGURE 4.—This diagram shows the combination of two input factors that will minimize costs of producing any selected output for a given production function and given factor prices.

For simplicity we consider a firm that is limited not only to a single economic stage but to a single durable factor. Using this framework we give detailed attention to the achievement of an efficient organization of production with emphasis on long-run planning. The short-run problem is simply to maximize net revenue with an existing plant.¹⁰

¹⁰ The input-output or production relationship of this type of economic construction is frequently expressed in mathematical terms as a single-valued function with continuous first and second order derivatives. The phenomenon of diminishing marginal physical productivity is usually considered operative, because a fixed plant is assumed to exist. Under such an assumption and with known price parameters, the solution follows easily. The most profitable combination of inputs, the optimum output and hence short-run efficiency are unique and are arrived at through simple maximizing procedures. For examples of profit-maximizing solutions for one and two variable input cases, see: Allen (2, pp. 609-610) and Henderson and Quandt (30, pp. 36-37 and 53-54).

The long-run problem is to select the most efficient size of plant in terms of lowest unit costs.

Derivation of Short- and Long-Run Cost

The production surface, or map, represented by the constant product contours (isoquants) $Y_1 \dots Y_4$ in figure 4 can be used to analyze some of the aspects of choice of the one-stage firm and to point to the essential distinctions between the short- and long-run situations. The production map represents the alternative levels of output achievable through use of productive resources X_1 and X_2 . The curves designated as Y_1, Y_2, Y_3, Y_4 , represent the constant product contours (isoquants).

Prices of the inputs are represented by the isocost lines I_1, I_2, I_3, I_4 . To approach an economic optimum requires selection of the factor combinations that minimize costs. This occurs at those points where the

various product contours are tangent to the isocost lines.

These solutions or cost minimizing points form the locus of what is frequently referred to as the expansion path or scale line. All combinations of inputs other than those falling on the expansion path, represent higher cost combinations. Since efficiency, as we have defined it, is concerned with achieving minimum unit costs, attention centers on the input combinations defined by this expansion path. The amount of total outlay involved in producing at each point can be computed and presented as a total cost curve of the form shown in the LRTC curve in figure 5.

This analysis recognizes the existence of only two productive factors, both of which are freely variable. For this reason the LR-TC curve of figure 5 represents a long-run total cost or planning

curve. If the amount of one of the productive factors involved is held constant while the other can be varied continuously then a short-run situation is defined. For example, if X_1 is available only as the amount OX_0 in figure 4 then the entrepreneur can produce only with those combinations of inputs defined by the line X_0A . Computing the outlay involved at each of these levels of production permits derivation of the short-run total cost function SRTC shown in figure 5. If X_1 were to be held constant at a number of different levels, a short-run cost curve could be constructed for each level, each tangent to the long-run curve at one and only one position. In the restrictive example used, each definable level of X_1 can be conceived of as a different size plant or collection of durable factors. An alternative way of drawing the long-run curve

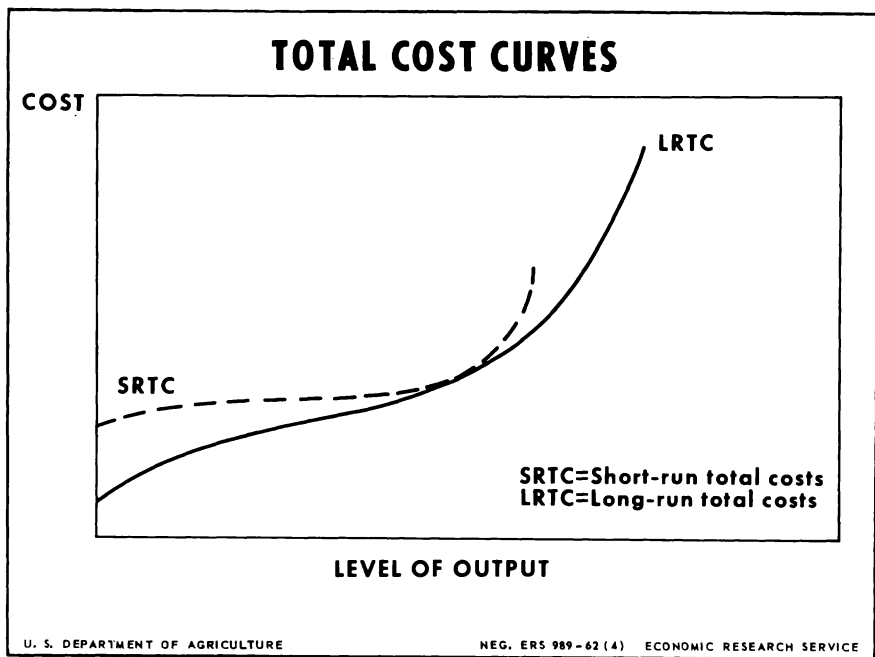


FIGURE 5.—Long-run total costs represent the outlay for input combinations along the expansion path when all productive inputs are variable (fig. 4). Short-run total costs correspond to total outlay for combinations associated with a short-run plant (such as line X_0A of fig. 4).

would be to derive a series of short-run curves associated with a range of plant sizes. The long-run curve then could be drawn to envelop the lower limits of total costs.

It follows from this that the primary distinction between long- and short-run situations is that in a long-run situation, plant size is a factor which can be varied. The long-run cost curve is a planning curve in the sense that initially the entrepreneur with adequate resources can choose any size of plant or level of X_1 he desires (62, p. 205).

Figures 6 and 7 present some hypothetical short-run plant alternatives and the corresponding long-run or planning curve in terms of total cost and in average unit costs. Short-run production possibilities for alternative choices of plants are represented by the SRAC curves (fig. 7). Although the implication of the smooth LRAC curve is that

numerous plant possibilities exist, only three are illustrated.

Economies and Diseconomies of Large Production

Both short-run (plant) and long-run (planning) curves of figures 4 and 5 permit derivation of U-shaped average cost curves in conventional textbook fashion. Figure 7 only shows a downward sloping portion of a conventional LRAC curve. The implication is that up to a point, economies in the form of lower unit costs result as the size of the firm's plant is increased. That economies of this nature are available is well supported by empirical studies. These economies arise primarily because a firm with a larger aggregate of resources has a greater range of technical possibilities than a small unit (14, p. 236). For example, many items of

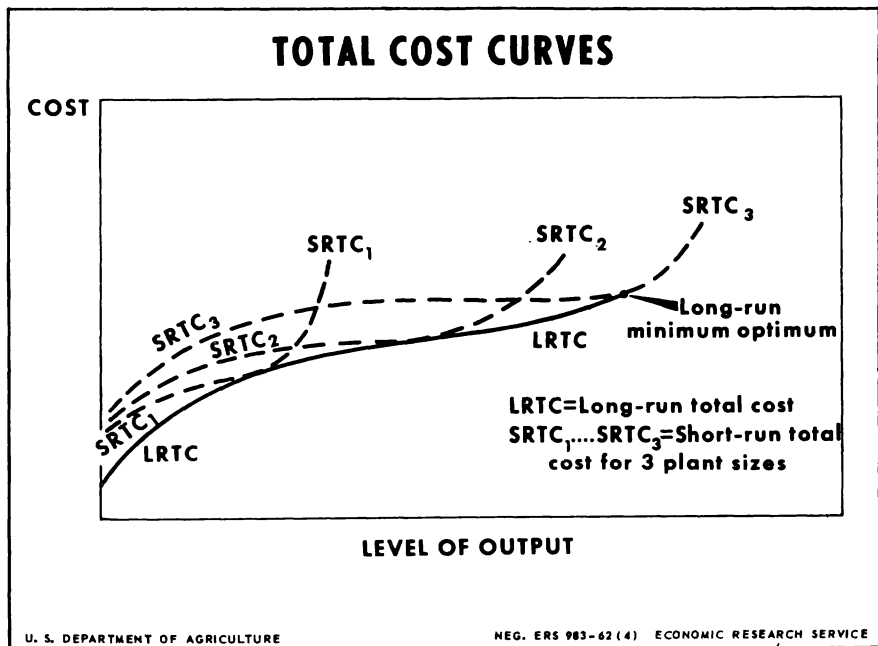


FIGURE 6.—Short-run cost curves represent short-run possibilities for alternative choices of plants; the long-run curve defines a limit below which no short-run plant curve will fall.

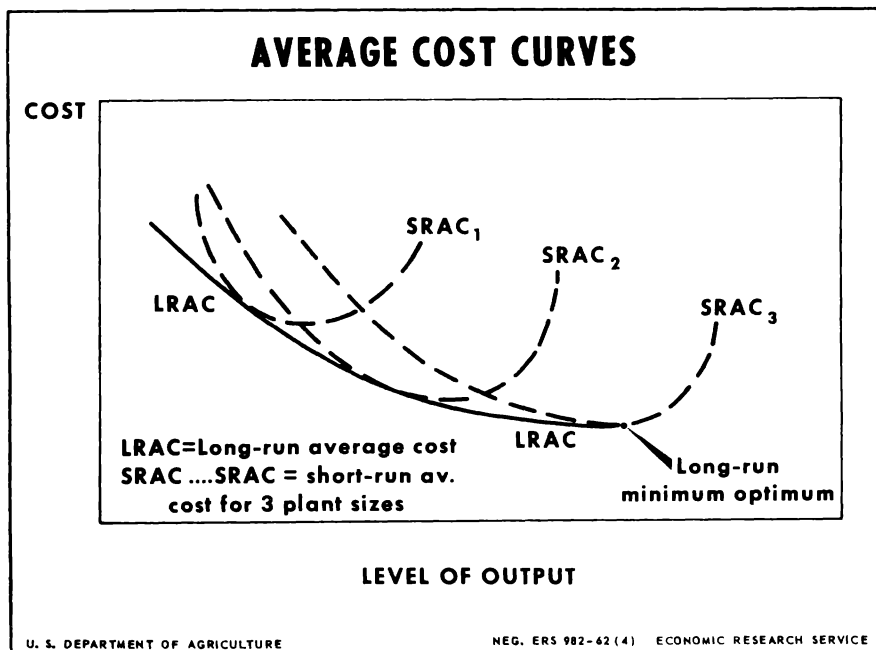


FIGURE 7.—This figure reflects the information contained in figure 6 in terms of unit costs. The short-run plant curves are now represented as SRAC curves and the envelope or long-run curve as LRAC.

capital equipment are available only in very large sizes. Hence, the large plant may be composed of qualitatively different and technologically more efficient equipment items than small plants. Also as plants become larger the firm usually is able to benefit from specialization of the functions of labor and management. Exploitation of these opportunities by firms able to develop larger plants results in lower unit costs. Larger plants are almost always more efficient than small plants up to a point. However, unit costs do not usually become indefinitely lower as plant size increases. The result is that while large plants have lower costs up to some critical scale of plant, further increases in size beyond this minimum-optimum scale lead to no further increases in efficiency (4, pp. 150-151).

In some industries the minimum-optimum scale plant may be very

large in terms of volume of output while in others maximum technical efficiency may occur at a relatively small scale.¹¹ When the most efficient size of plant and output volume is large, additional efficiency in terms of reduced costs may occur because of the economies of large scale distribution and of large scale buying.¹²

Economies of Large Firms

In addition to the obvious gains in efficiency made possible by choosing a minimum-optimum scale plant, the possibility also exists that a firm

¹¹ A very significant additional consideration here is the proportion of total industrial output a single plant of optimum scale will supply. Obviously if the scale dictates only one or a small total number of firms the issue of market power becomes significant. This is discussed in the next chapter.

¹² These are sometimes referred to as the net external economies of large production. See Viner (62).

can reduce costs still further by growing large enough to operate several optimum scale plants. An obvious example would be when the maximum-optimum scale of a single plant is not large enough to fully exploit the economies of large distribution and purchases. Some additional economies of large scale management may also result for the multiplant firm. However, as with the large plant it would be expected that at some finite size, opportunity for the firm to lower unit costs by further acquiring additional plants would disappear.

Rise of Diseconomies

So far we have given little attention to the nature of the firm's long-run average cost curve for plant sizes larger than the minimum-optimum scale. Does further expansion result in constant or rising unit costs? Some contend that because of inability to continue to expand the entrepreneurial function as size increases, there is a tendency for firms to become unwieldy, for administration costs to increase, and for unit costs to rise. However, others have held that such potential diseconomies need not exist, given the techniques of organization available to very large units.

If diseconomies are present they may be encountered at a scale only slightly larger than the minimum optimum. This gives the familiar U-shaped long-run average cost curve of conventional theory. In most situations it would appear that if diseconomies arise at sizes relevant to observable market conditions it is only at a size or scale considerably larger than the minimum optimum. When this is the case, a range of plant sizes may be equally efficient. Whether a particular industry will be characterized by few or many firms, by large or small plants, then depends on other factors.

Vertical Integration and Economic Efficiency

Thus far we have restricted the analysis to achievement of efficiency by a firm limited to a single economic stage. Let us next add a vertical dimension. The firm as a business organization now must consider not only the economies of producing at a single stage but also the economies of performing at preceding and succeeding production stages. Our interest is now focused on a situation in which the total unit cost of a firm performing several vertical functions may be lower than the sum of the unit costs of several firms each operating at one of the stages. According to previous definitions, the firm undertaking to perform two or more of these successive functions is said to integrate vertically. To discontinue performance of a process would be to disintegrate vertically. We will shortly consider other forms of vertical coordination.

Optimum Degree of Integration—An Elementary Model

Recognition of the vertical dimension of choice means that the long-run planning problem of the firm includes both the determination of the number of stages and the selection from among alternative production techniques and technologies of the appropriate ones to realize economies of scale at each relevant stage.¹³ As an introduction, let us consider the problem of determining optimum scale of operation within the extremely simplified framework shown in figure 8.¹⁴ In this illustration the shape of the cost curve is dictated by known technology and by the limited ability and capacity of management to

¹³ The plant now can include the necessary durable equipment items of separable successive economic stages.

¹⁴ This is an adaptation of a model presented by Blaich (8).

employ it. In practical situations this selection of technologies presents its own economic problems, some of which we will consider.

The function *a* represents the lowest long-run average cost at which the first process A can be operated. Function *b* represents the cumulative lowest average cost of operating stages A and B. Functions *c* . . . *f* are defined in the same way. The differences between each pair of adjacent constant cost functions represent the lowest average cost of adding the particular stage.¹⁵ Each function with the exception of *a* is assumed to be constant within a range of sizes relevant to this situation. The declining portion of curve *a* to *s*₁ illustrates the shape of the average unit cost curve under specialization at this stage. The declining portion of curves *b* to *f* are relevant only as part of a process of integration from stage A to stage F. The shapes of these curves indicate that as additional vertical processes enter, the organizational complexity of the aggregate cost structure increases and the horizontal output at which lowest unit cost or minimum-optimum size can be reached (*s*₁ . . . *s*₆) drifts to the right. This model implies that to be efficient, the minimum-optimum level of the integrated operation would probably be larger than the levels at which some of specialized stages would achieve lowest unit costs.

Within this framework the maximum size consistent with efficiency is not determinable. A variety of different sized integrated firms could conceivably coexist. In any given situation the firm apprais-

ing integration opportunities might be faced with organizational limitations. For example, if these were limitations in managerial capacity the relevant curves in figure 8 would probably change to include upward sloping portions such as shown by *aa'* . . . *ff'*.¹⁶ The drift to the left of points *v*₁ . . . *v*₆ registers the impact on maximum efficient scale of the increased complexity of coordination as stages are added. Thus as more and more of the successive processes are considered in the planning system, the horizontal range of output over which the relevant least cost can be achieved narrows progressively. In this instance, when vertical integration is carried to the point of adding stage E, the lowest attainable average unit cost lies above the lowest level previously attainable (the horizontal curve *e*). Under competitive pressure, this firm would be forced to limit the number of vertical stages or to expand its managerial capacity.

In the above example a firm organized to include stages A to D represents the highest degree of vertical integration that would be considered in the interest of efficiency. But this solution would be valid only if this was the only feasible direction of integration. To a firm appraising the opportunity to integrate backward from F to A or both forward and backward from level C, the picture would be quite different. The model is further limited because of the omission of revenue curves. With this omission it is not possible to determine the relative profitableness for the various degrees of integration. A firm with limited capital as well as management capacity might find it more profitable to specialize and expand

¹⁵ If these differences represent separate economic stages, the set of least-cost functions is determined by ordinary cumulative addition. When input relations are complementary or competitive, addition is influenced by joint costs. The existence of joint costs, of course, complicates the accounting problem. See Ciriacy-Wantrup (15, p. 774).

¹⁶ Limits to capacity of management may be real, in the sense that the problems of coordinating production activities increase with scale, illusory to the extent that attitude toward risk and uncertainty is unduly pessimistic.

at stage A even if it were possible to finance an efficient integrated plant combining stages A and B. With these points in mind let us next consider the way in which the economies of vertical integration arise.

Rise of Integration Opportunities

In a general sense, determination of the optimum degree of vertical integration is part of the firm's problem of choosing what and how much to produce. This in turn depends upon the extent to which production possibilities are complementary, competitive, or independent in terms of total costs and revenues.¹⁷ The possibilities appear to be so widespread that multiple-stage and multiple-product operations are more common than single-stage production.¹⁸

In this study we do not consider the problems associated with choices between alternative lines of production. Attention is confined to choices of additional vertical stages. Economies of vertical integration and other forms of close vertical coordination arise from at least four sources. First, they come from bringing technologically complementary productive processes together in a single plant (as already mentioned). Second, they result from elimination of expenses of purchase-sale transactions incident to moving goods from one stage to the next. Third, they may follow from elimination of profits to supplier or customer firms in excess of a basic interest return on the added

capital investment. Fourth, there are economies from the improved coordination of rates, amounts, and quality of output at successive stages (permitting, among other things, reduction of inventories) (4, p. 156).

The ability of an individual firm to realize these economies through vertical integration depends in part on its size and capital position. The number and size of the firms at the stages in which there are prospects of integration and the potential for demand expansion for the commodity are also factors. In many instances a firm may achieve the same economies through other forms of vertical coordination. Firms that are relatively large and have substantial market power may find these alternatives more profitable. We discuss these situations later.

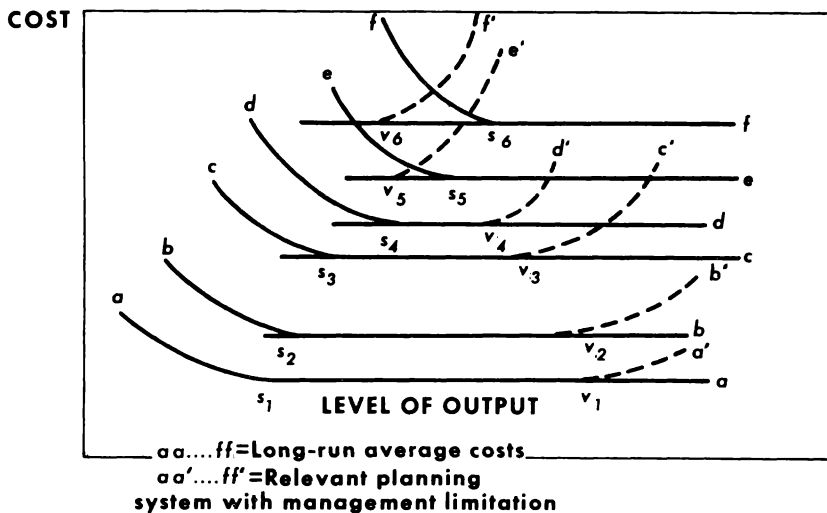
Choice of Technology.—It is common in many economic studies of the behavior of firms to assume that the entrepreneur is aware of his production-technology alternatives and can concentrate his attention on that technology that has technical efficiency. The long-run planning curve of conventional economics represents only efficient plants for a known set of product and factor prices. But this assumption of full knowledge of technical conditions is often erroneous. An important phase of choosing a firm's plant is the problem of assembling information sufficient to assess the relative efficiency of alternative technologies and to estimate the rate of technological change.¹⁹ Serious errors may occur even when the decision scope of the firm is narrow, but the chance that the actual choice will deviate from the opti-

¹⁷ While complementarity in total net revenues is a necessary and sufficient condition for joint production, complementarity either in total gross revenues or total costs although necessary is not a sufficient condition, since, for example, the influence of competitive cost relationships might offset the advantages of complementary revenue or vice-versa. See Ciriacy-Wantrup (15, p. 774).

¹⁸ For a profit-maximizing model of a farm representing a collection of vertical and lateral stages see Heady (28, p. 264).

¹⁹ Koopmans (37) suggests that to ignore the extent to which the decision-maker must make choices between alternative technologies at each level and the economic implications of these choices is to ignore much of the economic problem.

LONG-RUN PLANNING SYSTEM



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FIGURE 8.—The long-run planning system for a firm constructed to show successive vertical and horizontal structural combinations.

num increases as the decision area is extended to encompass more vertical stages.²⁰

One group of researchers, studying the pear-packing industry was led by the complexity of the technology-choice problem to suggest that analysis must begin with the individual economic stage. Efficient technologies must be determined for each rate of output, stage by stage.

²⁰ Furthermore, uncertainties due to lack of knowledge and change are very real components of a dynamic economy. Changes in technological, economic, or institutional factors may render a relatively efficient plant obsolete within a short period of time. Once a plant is chosen, subsequent choices are modified by its existence. A portion of the resource bundle available to the entrepreneur is now invested in the form of specialized durable equipment items. Inasmuch as the decision to so invest are nonreversible these become sunk costs. The "best" long-run solution may be the one which stresses ease of adjustment to changing situations. Adjustment may be greatly facilitated by (a) built-in flexibility, and (b) ease of alteration.

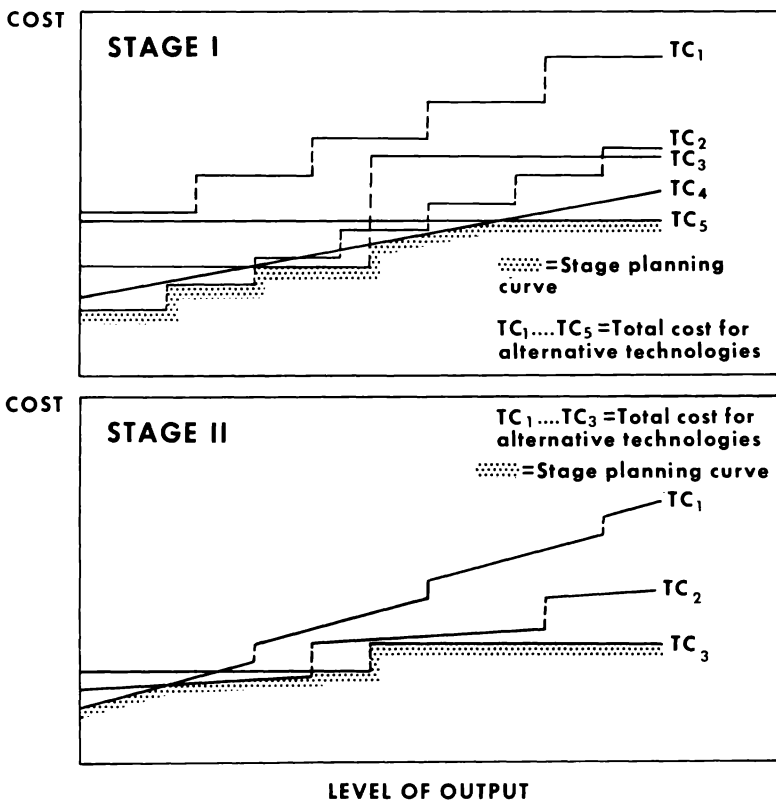
Stage-cost functions representing only efficient technologies can then be aggregated into a long-run total cost function. The procedure is applicable only when "economic stages" can be isolated.²¹

The curves in figure 9 represent several alternative technologies for two economic stages. Each curve shows the total stage cost per production period (including operating costs and an allowance for replacement of the durable factors) expressed in relation to level of output.²² The portion of each curve that represents the lowest cost at

²¹ An economic stage may be composed of several technical stages. Given the rate of plant output, the use of a certain technology at one stage may limit or modify the use of some other technology at other stages. The minimum cost technology in this case can be determined only by joint consideration of all stages so related. See French, Sammet, and Bressler (25, p. 574).

²² The type of situation illustrated appears to be much more characteristic of agricultural processing than of farming.

COST FUNCTIONS FOR ALTERNATIVE TECHNOLOGIES



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FIGURE 9.—The portion of each curve that represents the lowest cost at each level of output may be viewed as a part of an envelope representing the long-run cost function for each stage.

any given level of output may be viewed as a portion of an envelope drawn to obtain the long-run cost function for each economic stage. The stage functions may then be aggregated to determine the total long-run planning curve. One characteristic of these relationships should be noted. The magnitude of the discontinuities in the long-run cost functions tends to decrease, as the number of alternative technol-

ogies available at each stage increases. Similarly, the magnitude of the discontinuities decreases again as the cost functions for several stages are aggregated into a total cost for the firm.

Reconciliation of Scale and Impact of Size and Market Position

The foregoing models indicate the nature of the problem of technical efficiency at each stage. The analy-

sis assumes that the horizontal-scale optimum of the integrated stages could be reconciled in a satisfactory way. In practical situations it would be unusual for the optimum output of one stage to coincide exactly with that of earlier or later stages. To achieve overall efficiency would probably require an increase in the size of a smaller stage above its minimum-optimum level. The critical optimum scale then is that of the largest stage. If overall efficiency is maximized within the relevant range, there will be a tendency for at least this critical scale to be imposed on the whole integrated operation. This will be true so long as no significant diseconomies of large-scale operation are encountered.

When the critical optimum scale dictated by the largest stage is very large relative to levels at which diseconomies arise in other stages, efficient vertical integration would involve several plants of at least minimum-optimum scale at these stages. The firm containing the largest scale of operation for the stages under consideration will often be in a superior position to realize the economies of integration and hence would tend to become the integrator. If the larger size also represents a larger total concentration of resources and market power then the tendency will be enhanced. If outside sources or outlets are readily available and can be used to balance surpluses and deficits, then it is not so crucial that the critical optimum scale be imposed throughout (4).

As an illustration, consider the following example. Available evidence indicates that economies of size in a cattle feeding operation may be realized at a much smaller daily volume of slaughter animals than is required for an efficient slaughter plant operation. It is unlikely that a cattle feeder would be large enough to find it economically feasible to set up a meat-

packing operation to handle his output of slaughter animals. However, an efficient small meat packer could undertake cattle feeding to supply only a part of his needs and still realize economies of large-scale production at the feeding stage. On the other side of the picture, the efficient small meat packer does not find it economical to integrate forward into grocery wholesaling or retailing as meat forms only a fraction of the total merchandise that must be handled.

Market Structure and Realization of Coordination Opportunities

As previously discussed, opportunities for profitable integration arise in different ways. Regardless of the form taken, their existence is usually a result of a change in production or marketing conditions. Change may arise from advances in technology, shifts in demand, or transformations in institutional patterns. More subtly, it may take the form of increased knowledge regarding production techniques. The change may be unique as it arises from an individual firm's experience or research, or it may be general with profit opportunities for those who first see and grasp the advantage. In theory, each firm in the vertical structure stands as a potential integrator with respect to general changes. Existence of profit opportunities through integration, however, does not imply that firms at all levels have an equal chance to take advantage of these opportunities, or even that these opportunities are of equal magnitude from the viewpoint of the firms at each level. These unequal opportunities appear to be due primarily to the different degrees of concentration of resource and market power in the firms of the existing industry structure. This existing structure then does much to dictate for whom the move

would be economical and hence the direction of subsequent integration.

For instance, Ward points out that the introduction of the paper carton for milk in Montana several years ago increased the scale at which processing and packaging milk was economical (63). Processors who adopted the paper carton expanded operations. Small distributors were forced to disintegrate their own processing plants and become strictly specialized distributors for milk or subdealers of the larger integrated processor distributors.

The development of farm bulk-holding tanks and bulk pickup of milk offers another example within the same industry. This transformed the processes for storing milk and transporting it from the farm to the distributor's plant. In theory, opportunity existed for processors, dairy farmers or independent operators to invest in the necessary equipment and to be in a position to extract the innovationary profits from the new system. But previous market conditions in many areas had led to a growth in size of processing plants so that a single plant serviced many small dairy farms. Size and market influence allowed the distributor to specify very closely the conditions under which milk is purchased and enabled him to control the rate of adoption of bulk-milk-holding equipment by farmers. By demanding rapid conversion of facilities and at the same time offering financial help, he could gain more control over production decisions and play a large role in determining which producers grew and by how much. In addition, his size and capital position often allowed him to integrate into the milk transportation stage and to reap the innovationary profits.

In other situations, a need for specialization and expansion in stage size may encourage growth of a new stratum of firms. These

examples serve to illustrate how forces that appear the same for firms at the various levels may lead to widely different results. This is especially so with respect to the direction of integration as influenced by previous size, strategic position, and so forth.

Agriculture, Vertical Coordination, and Economic Efficiency

In the cattle feeding and dairy farm examples, it was suggested that nonfarm firms are better able than farm firms to initiate and profitably exploit integration and other forms of close vertical coordination. Farm firms, despite a general increase in size, are usually much smaller than the nonfarm firms with which they deal. Economies of most agricultural supply, processing, and marketing businesses can be achieved only through mass production and distribution techniques. The applicability of such techniques on farms is limited. As a result, stages of nonfarm plants usually are efficient only at a volume large enough to supply, or use the output of, many farms. For example, only an unusually large farm could economically integrate airplane spraying and dusting. This partly explains why the popular concept seldom envisions the farmer as the dominant party in vertical integration and contractual arrangements.

Vertical Integration and Disintegration by Farmers

The main area in which farmers initiate vertical integration occurs within what is commonly recognized as farming business. The farmer or rancher does not usually think in terms of vertical stages, integration, or coordination. To him it is a question of whether to specialize further, to enlarge present operations or to add another enterprise. Should he sell corn or feed it to hogs? Should he grade and pack

his apples or sell them ungraded in bulk to the processing plant? Often the decision turns in favor of using his available resources at fewer stages rather than more. Today's farmer is buying more and more of his inputs. Jobs that he formerly did, such as growing feed, raising young stock, combining wheat, spraying orchards are now frequently hired from other specialized firms.

Farmers could continue to include these stages of production in their operations but find that limited capital yields a higher return by being concentrated on reaching a minimum-optimum scale for fewer stages. The disintegrated processes have been turned over to what are often new specialized firms that are large enough to realize economies of scale. When farmers discard or give up stages, the subsequent coordination of these stages often takes the form of contracts rather than making use of the traditional forms of market pricing.

Many farmers are integrated into marketing stages on a small scale through such avenues as roadside stands or retail egg routes. Local market conditions often explain this activity although sometimes the reason may not be economic. Integration into processing and marketing channels may develop from the growth of an individual farm firm that has unusual capital and managerial abilities. This is particularly true if the minimum-optimum scale of the succeeding stage can be approximated. For instance, in recent years many California dairy farms have increased in size until the volume of milk from one farm is sufficient to supply much of the Grade A milk demanded in a given area. New developments in technology made processing and marketing functions economical at a smaller scale. These factors combined with a shift in milk buying patterns away from retail delivery routes in many cases make it profit-

able for such dairy farmers to open milk depots on their farms or nearby.

As another example, the volume of eggs on many large poultry farms together with improved equipment made it economical to incorporate the grading and packaging stage into the farm business and brought some increase in on-the-farm processing. Increasing disparity between farm and city wage costs may be a related factor.

Farm Cooperatives and Vertical Integration.—Agricultural cooperatives overcome certain of the limitations that individual farmers face in integration and other forms of coordination with nonfarm stages. Pooling of output, buying capacity, and capital resources may permit small operators to integrate (in effect) into stages in which mass production is necessary to achieve efficiency and to circumvent monopolistic or monopsonistic exploitation. They may also relinquish some of their traditional functions to the joint venture in order to gain the economies of specialization and mass production. Increased size and pooled capital give access to the hiring of a specialized manager to supplement farmer skills. Through buying or selling as a single unit, the cooperative may realize external economies by virtue of the size of purchases or sales. These include quantity discounts for large purchases or more favorable prices because of increased offerings. Profits may be further enhanced by the members acting in unison to control quantity and quality of inputs such as feed or seed and fertilizer.

Other Types of Joint Effort.—Formation of a cooperative represents only one of a number of types of joint effort in which farmers may participate to achieve efficient integration of succeeding or preceding stages. Use of conventional cooperative forms has advantages in

that the structures are well defined and a wide range of technical assistance is available through public agencies at the State and Federal level. In addition, specialized financing services are available to qualified applicants through the Bank for Cooperatives of the Farm Credit Administration. However, the conventional form of the cooperative may not be the most appropriate type of organization for some of the diverse situations in which joint efforts by farmers or farmers and others would be advantageous.²³ In some situations an efficient scale of operation may require more capital than can be committed or raised by farmers alone under the usual form of cooperative. Then some other form of incorporation may more readily gain access to more adequate methods of financing.

For example, in a number of Montana communities there is current interest in the possibility of combining the resources of local businessmen and ranchers and operating a custom cattle feedlot. This provides a means for member ranchers to efficiently finish cattle on local feeds, increases marketing opportunities, provides an outlet for local investors, and serves as a stimulus for community growth.

It appears that the position of the farmer and his ability to appraise coordination opportunities would be greatly enhanced if he were more aware of the advantages and disadvantages of the number of alternative ways in which he might combine with others to attain coordination. However, little attention has been paid to this problem by research agencies, beyond the recognition accorded conventional cooperative structure.

Vertical Coordination Between Farm and Nonfarm Stages

From the examples given, it is evident that the phenomena of vertical coordination occur at all levels of the economy. Any firm is a potential integrator. At what level integration will be initiated, and by whom, is determined by a variety of factors. When integration possibilities arise in agriculture, as we have pointed out, the advantage often lies with the firm operating at the nonagricultural stage. Sometimes this results in a form of complete vertical integration. For example, certain cigar companies own and operate farms for producing wrapper tobacco. Some vegetables for freezing are grown on company-operated farms. And some broiler operations—from hatching eggs and feed supply through farm production to processing—are all carried on within single firms. The profits from strict control of quality, quantity, and scheduling of factor inputs often are the main reasons.

However, as a general rule, the merging of farm stages with nonfarm businesses is less common than the vertical integration that occurs within nonfarm business or even within agriculture. The reason for this appears to be that some of the specific economies of vertical integration, which play large roles in dictating the merger of nonfarm or intrafarm stages, may be less important between farm and nonfarm processes. For example, the fundamental differences in farm and nonfarm functions may allow less opportunity to reap benefits of technological complementarity in determining the scope of the firm plant. In addition, the amount of investment in a farm plant as compared with that in a nonfarm plant is high relative to rate of return and volume of output or sales. Thus vertical integration to realize profits at the farming stage as well as at the non-

²³ For further discussion of the type of economic problems that may arise with this type of organization see Phillips (50), Aresvik (3), Savage (54), and Trifon (59).

farm stage would usually be ruled out because other investments offer better prospects of return. Perhaps a more important reason why there is no general tendency for nonfarm stages to expand to include farming functions is that the nature of farming activities and the potential economies are such that the nonfarm firms can often realize a large measure of the economies with another form of coordination. In many instances, the relevant economies appear to be those that arise primarily from achieving better control of quality, quantity, and timing of output, and the scheduling of factor inputs at the farm level than is offered by traditional markets. In situations in which the nonfarm stage services or absorbs from a large number of farms these economies can often be realized through contracts.

Contracts have the advantage of being specific in the area of control. This permits the firm to extend its influence vertically over a much larger horizontal area than its resource endowment would allow it to absorb through complete integration. For example, available capital may allow a firm at level B to own and operate a minimum-optimum sized plant at preceding stage A. The output of this plant may represent only a small portion of the product needed to supply the integrating firm. In such a situation, production contracts offer a further advantage. They make it possible for the firm at stage B not only to synchronize the output of both stages but to use its limited capital resources to expand its operations to a more profitable level than would be possible were full investment in stage A required. Another important reason for contracting as opposed to integration is that contracting permits more flexibility in operation. Processors or dealers can expand or contract farm production more quickly and shift among areas, commodities, and

producers with less concern over fixed capital investment. Short-run experiments with products or techniques can be made with reduced risks.

In some situations when a farm and a nonfarm business make a production contract it is difficult to determine which is the prime mover. Each party to a contract obligates himself in certain respects and also receives some benefits. But despite the two-way nature of the contract the nonfarm processor or dealer is usually the initiating and policy dictating party. He often makes such important decisions as specifying acceptable quality and timing of production, provides such inputs as seed, feed, chicks, and livestock, and assumes the responsibility of marketing the final product. The farmer, unless a member of a cooperative association, can only accept or reject the offer made by the nonfarm firm, or find another outlet.

However, complete control is not always necessary or sought by processors. What they want chiefly is to have enough control of quality, quantity, and delivery schedules of products needed from farms to assure efficient operation of their plants and retention of their markets. As a result, although the nonfarm firm initiates the contracts, there may be mutual benefits. The farmer may profit through improved prices as the quality of his product is improved to meet processor specifications. Mutual agreement may also result in elimination of an intermediate stage resulting in higher profits for all remaining participants.

Even when these gains are not forthcoming such arrangements may help stabilize and maintain the level of farm income. Price uncertainty may be lessened. Sometimes the farmer is relieved of certain production risks. Producers lacking adequate working capital or who do not wish to risk their own capital

can often obtain it in the form of services and supplies. For some producers, particularly where new developments are occurring, it is a way of acquiring advanced technology and specialized management. A contract usually also provides an assured market, especially important when the product is per-

ishable and requires immediate processing. Having a contract may determine whether or not an individual will produce the commodity in question. This has long been the situation with respect to fluid milk production in many areas. Broilers, sugarbeets, and peas for processing illustrate the same point.

CHAPTER 4.—MARKET STRUCTURE AND ADVANTAGE

The possible gains from technical efficiencies arising from various forms of vertical coordination were considered in Chapter 3 under the theory of profit maximization for the individual firm. But there are other ways in which particular forms of coordination may serve to maximize profits. A body of theory known as market-structure theory has been developed in recent years to explain the performance of the market as a whole in terms of the aggregate behavior of firms and the interactions between them. In a world characterized by concentration in many lines of business and an awareness of interfirm relationships, the structural anatomy of the market can have a great deal to do with market conduct (61).

Market structure as defined in industrial organization theory has come to mean "the relations of sellers in the market to each other, of buyers in the market to each other, of the sellers to the buyers, and of sellers established in the market to other actual or potential . . . new firms which might enter the market. In other words, market structure for practical purposes means those characteristics of the organization of a market which seem to influence strategically the nature of competition and pricing within the market" (4, p. 7).

The main constituents of market structure are usually stated in terms of the degree of seller concentration, the degree of buyer concentration, product differentiation, and conditions of entry and exit. Vertical integration may be considered as

part of structure or as caused by structure, according to circumstances.

"Market conduct" and "market performance" are other terms associated with market structure. Market conduct refers to business behavior in the presence of particular structures. Examples are methods of arriving at price and product policy, advertising and promotion, and tactics and strategy toward competitors. Market performance refers to how well an industry performs in terms of aggregate efficiency, progressiveness, stability, and other results.

Market advantage may be considered to be the ability of a firm involved in a particular structural environment to influence price and market policies for its own benefit. This ability is sometimes referred to as "market power". Unfortunately, however, this term suggests a greater scope of dominance and of social consequences than is intended. By market advantage, we mean the advantage that a firm gains as a direct result of its own action beyond what would happen in a perfectly competitive situation. The concept was originally applied to static situations, but it has been enlarged to deal with dynamic circumstances as well.

Market Conduct in Nonfarm Businesses

Market advantage as a motivation for vertical integration and other forms of vertical coordination may operate in two ways. First, the existence of a certain advantage

structure is a precondition that may encourage vertical integration. The possible enhancement of market advantage then becomes a further incentive.

Nonfarm business firms sometimes use vertical integration to obtain additional market advantage, either through vertical growth or through vertical merger with other firms. Large horizontal size is the basis for the original market advantage. This motive for vertical integration would arise under conditions of oligopolistic market competition. In some instances, it is related to strong control or near monopoly of one or more crucial stages in the sequence of production and marketing.

Distinguishing the motives for vertical integration is difficult because several are usually intermingled. As vertically integrated firms grow horizontally, they often become more profitable through economies of scale, as well as through gains in market advantage. But firms may continue to expand beyond the point of maximum optimal size solely to increase their influence on markets, either forward or backward. The action toward vertical integration that firms take may be for the purpose of protecting existing markets or as a means of aggressively expanding market influence.

Exclusion of competitors from certain areas or handicaps placed on them may be inherent in large vertically integrated firms regardless of the original motive for integration. Market advantage may be especially effective if nonintegrated firms participate in the successive stages and are forced to sell or, to buy from, integrated firms at each separate level (4, p. 513-515). Integrated companies often are willing to deal with independent firms only on terms unfavorable to the latter. Unless the competing firm is large enough to finance its own entry into the

controlled stages, operating conditions may be unfavorable. For example, if an integrated banana company controls most of the specialized ships used to transport bananas, it may have a strong market advantage over the production and distribution stages of bananas handled by other firms.²⁴ The fact that integrated operations are often more efficient is another factor that permits a price advantage when competing with nonintegrated firms in the final market, but this is a technical advantage. Bain points out that vertical integration which imposes some restraint is not in itself illegal under the Sherman Act. The character and extent of restraint are crucial. Whether or not situations are judged to be illegal depends upon their reasonableness, as in judging horizontal integration. And . . . "vertical integration with implicitly restraining influences is likely to be found illegal only in cases where it is conjoined with predominant horizontal market control . . ." (4, p. 517).

The aluminum industry is a commonly cited example of forward vertical integration for the purpose of gaining access to markets, a form of market advantage. At first, aluminum was a new product. Sales were small because of unfamiliarity with its use and competition with other metals. To develop markets, it was necessary for the company producing it to integrate completely—from mining and smelting the ore to the manufacture and distribution of aluminum pots and pans.

A shoe manufacturer who forms his own retail shoe stores and a movie producer who buys a chain of theaters are other examples of vertical integration to exert some degree of market

²⁴ It may be objected that the advantage lies in the monopolistic shipping stage rather than in the vertical integration. But vertical integration means that favored treatment can be given the vertically integrated firm.

control. In each of these instances, the strategy used places the integrated firm in position to protect or improve its markets. In certain locations, control of retail outlets (for shoes or film) permits the integrated companies either to exclude competitive producers of shoes or film, or to buy these products at favorable prices.

Under the current great productive capacity of American industry, integrating forward for purposes of gaining market advantage is apparently resorted to more often than integrating backward. Product markets seem more limited than resource markets and greater effort is given to selling than to buying. Nevertheless, integrating backward occurs when particular resources are scarce. During and immediately following World War II, there was an upsurge of interest in backward vertical integration because of abnormal supply conditions. A few grocery chains, for instance, began to feed cattle to be assured a regular supply of beef for their stores. In the cotton textile industry, an acute shortage of gray goods at that time "led converters, selling houses, apparel manufacturers, industrial users, and even large merchandising organizations to acquire ownership in or control over primary textile manufacturing facilities" (1).

Nonagricultural firms attain a substantial amount of market advantage through the general structure in which they operate. "In those industries supplying important inputs to agriculture, such as automobiles and trucks, farm machinery, chemicals and oil, are found relatively few numbers of firms with some few having significant parts of industry output, differentiated products, and barriers to entry. Vertical integration is common, the corporation is the dominant form of organization, with hired labor" (16).

The individual firms in such a structure are aware of each other's actions and are able to schedule output to meet the particular level of

demand. The motivation for further integration between these businesses and the farmer is not very great in such situations. Somewhat similar market structures are found in the nonfarm businesses that buy farm products.

Industry-Agriculture Integration

The possibility of gaining additional market advantage does not appear to be as strong a motive for vertical integration in agriculture as it is in other businesses. For many farm products the food and fiber industries find little gain in integrating backward because the inelastic nature of farm production and the characteristic market structure already provide them a market advantage by carrying back to farm producers many of the consequences of unfavorable market conditions. Nor do they need to worry greatly about obtaining access to most of the major farm products that move through central markets. For crops and livestock that require processing, contracting is frequently used, and the dominant positions of the processing concerns may enable them to use this means of coordination more effectively than integration.

But limited vertical integration with farm production may assure the processor of some protection against shortages or lack of uniform movement during the processing season. Evening out supplies in this way may also prevent some violent price swings. This may explain why 3 or 4 percent of the supply of fed cattle continues to come from integrated feeding operations of chain stores and packers. These controlled supplies provide a reserve flexibility to smooth out irregularities in purchased supplies. They may serve to stabilize prices at particular times when shortages might otherwise develop.

The primary reason for the general lack of vertical integration of business firms with agriculture for

purposes of market control lies in the conditions of production that characterize most kinds of farming. Farm firms are numerous and relatively small, and they produce mainly products that are undifferentiated. Compared with many business and industrial firms, it is easy to enter a farming enterprise because of the relatively small amount of investment and technology needed. But it would be difficult for a food processor-distributor to acquire control of enough farm production facilities to have much influence on prices or markets for most major commodities. Conversely, few farm firms are so large that they can exert much market influence by vertically integrating forward into food processing or distribution. In short, it would be difficult for any single firm to control strategically the output or input markets for any important segment of agriculture, and such control would be necessary for vertical integration to achieve price influence to any great extent.

A number of special situations, however, exist in agriculture in which vertical integration exerts some effect on prices or markets. Producers of quality seeds, high-class breeding stock, and other highly specialized farm products have some market advantage arising from product differentiation and the structure of markets which may encourage some vertical integration. Given certain locational advantages, for example, a producer of vegetables or fruits may obtain substantially higher prices by integrating forward vertically by means of a roadside stand. By integrating into the production of livestock, a feed dealer can assure or expand his sales of feed. By producing some peas on his own farm, a processor may influence the price he pays for peas he buys from others. In most instances, however, the area of price or market influence is relatively small.

The formula feed manufacturing industry may represent a unique situation in which the special market structure provides reasons for forward integration. Rapid advances in technology, rapid expansion in volume, and availability of the feed-industry capital represent associated circumstances leading to special means of vertical coordination. As in the aluminum industry, some of the initial reasons for vertical integration may disappear later as the industry matures.

Developments in this area are suggested by the chairman of the board of a large national feed manufacturing concern in a recent annual report (24, pp. 1, 85).

"As we look toward the future, it seems apparent that our company will tend to become still more diversified in the food field, which is our business. One step in this direction is further integration in poultry; in simplest terms this means that we will control all stages of certain quality poultry operations, from ownership of the breeders and the hatchery, and management of the production facilities, right through to the final processing and marketing of the eggs and poultry meat.

"During this past fiscal year we have acquired such control of . . . (a large turkey operation) . . . in California. Since October 1 and as we go to press with this annual report, announcements have been made of the acquisition of three additional companies . . . (one) in Waterville, Maine, . . . (and two) . . . in Alabama.

"We believe that these moves are in the best interest of . . . (our corporation) . . . of our new associates, of American Agriculture, and of the consuming public."

Farmers and Market Advantage

Rhodes concluded in a preliminary theoretical analysis that "Farmers generally do not have

market power unless there is supply management. Agricultural marketing firms have some degree of market power in non-atomistic situations.”²⁵ He considered how prices might be influenced under several degrees of integration and types of market structure. For simplicity he selected four situations for discussion:

- (1) Vertical integration of atomistic firms—every peach orchard sells through a roadside stand, for example.
- (2) Vertical integration of oligopolistic marketing firms.
- (3) A farm cartel with a vertically integrated sales unit handling one-fourth of its output and an independent market firm handling the other three-fourths.
- (4) A market monopoly with a vertically integrated farm unit producing one-fourth of industry output and the other farm output handled by a cartel.

Rhodes’ analysis was simplified and limited by assuming that the product is perishable so that no carry-over would affect price, and that unit marketing costs do not vary with changes in volume.

In situation one, he concluded that no market advantage would be gained. Vertical integration of atomistic firms would not change consumer prices or output harvested in either the short- or the long-run. In situation two, that of an oligopolistic firm integrating backward into farm production, the resulting organization would not be expected to be any more profitable than the firms were before integration. Under heavy output, the integrated firms might find it more difficult to arrive at tacit control of marketings

than to obtain tacit abstinence from bidding down the profit margin when buying from farmers. What the vertical integration would accomplish would be to make the marketing firm, now also a farm firm, more interested in some form of supply management. As a non-integrated oligopoly, it was more interested in maintaining a profit margin on a large volume.

But for situations three and four, Rhodes concluded that “The cartel or firm with complete control at one level and a vertically integrated supply or outlet at the other level is in a very advantageous position to restrict the margin or price charged by the other firm . . . While a vertically integrated cartel could restrict the market margin, its own behavior would need to be restrained from profit maximization if the consumer results are likely to be socially acceptable.”²⁶ Situations three and four may not be representative of many real life situations. Such circumstances might arise with some specialty crops or where strong agricultural marketing or bargaining associations exist for products in limited areas. The development of a differentiated product through a special brand name together with a judicious adjustment of the quantity of product permitted to flow into this brand category may enable a cooperative to gain some market advantage from a vertically integrated arrangement. This approach has been used by several well-known cooperative brands.

²⁶ The ability of a firm to achieve market advantage through vertical integration has been disputed by some economists. For example, J. J. Spengler in a paper on vertical integration and antitrust policy a few years ago held that: “Vertical integration does not, as such, serve to reduce competition and may, if the economy is already ridden by deviations from competition, operate to intensify competition.” Examination of Spengler’s assumptions suggests that he considered a very restricted and special case, however (56).

* ²⁵ Rhodes, V. J. “Supply Management, Market Power, and the Derived Demand for Farm Products,” unpublished manuscript, Econ. Res., Serv. U.S. Dept. Agr., 1961.

Cooperation

Significant market advantage to farmers is frequently achieved through cooperatives. The activity of a farmer cooperative is a form of coordination between farm production and marketing stages. Usually farmer members of cooperatives continue to operate their farms as separate businesses but agree to join together in certain stages of their operations such as bargaining, purchasing supplies, or marketing output.

Through joint ownership of the association the farmer members, as an organized group, are sometimes said to integrate vertically backward into the production or purchasing of feed, fertilizer and other input items, or forward into the marketing, processing or distribution of farm products.

In terms of the definitions used in this report we would say they coordinate vertically by means of cooperation. In addition, through contracts and agreements between the individual farmer member and the cooperative, farm production and production practices may be coordinated with a net effect similar to that achieved under vertical integration.

More than 9,000 farmer cooperatives engaged in marketing, farm supply, and related services were listed in 1960 by the Farmer Cooperative Service. Total membership in these associations was more than 7 million, but this includes some duplication for those who were members of more than one cooperative. It is estimated that about four in every five farmers belong to one or more farmer cooperative.

Farmer cooperatives in 1960 handled about one-fourth of all farm products sold and one-fifth of the basic farm supplies purchased. The significance of farmer cooperatives in the agricultural economy is even greater than one might think from these figures alone.

Cooperatives have frequently promoted the adoption of new and more efficient methods, lifted prevailing standards of business practice and served as pilot operations for larger segments of an industry.

Even though the cooperative's share of a market may be small the unique feature of providing services at cost may establish patterns of market operation. For example, participation contracts in the Concord grape and citrus activities by noncooperatives are patterned after the cooperatives' pool method of payment.

Reducing costs or providing more services are among the reasons for forming cooperatives, but the seeking of market advantage may be important also. Bargaining cooperatives, for example, are almost solely organized for the purpose of obtaining marketing advantages comparable to those available to other businesses. Here we must recognize that the terms "bargaining power," "market power," and "market advantage" are somewhat lacking in precision and have a convenient flexibility. Kenneth Naden, National Council of Farmer Cooperatives, recently called attention to this by writing that:

"Market power, or bargaining power, can be used both defensively and offensively and consists of every conceivable range of influence from that of the small, unorganized farmer to the large commercial farmer, to the small farmer cooperative processing organization through many steps to the larger units of organized labor (and industry) of the country which stand at the very apex of market power."

The impact of cooperatives can be exerted in two general ways. It can provide services more efficiently and it can achieve market advantage by gaining a relatively large share of the market in which it is interested. If the market structure is a highly competitive one, it must be changed to one with

oligopolistic characteristics. Where production is narrowly limited because of climate, soil or other conditions, or where certain market barriers exist, elements of market advantage may be most easily obtained.

Further, the potential of cooperative growth may act as a deterrent to excessive margins by all organizations providing similar types of services.

Beginning in the latter part of the 19th century the citrus growers of California began to organize local cooperatives that eventually developed into what is now known as "Sunkist Growers, Inc." This cooperative development is in fact a marketing system encompassing pooling of output and vertical integration of processing, storage and marketing activities. Taking the total annual production of marketable citrus as furnished by members, the cooperative utilizes all available means for maximizing returns from the supply. This assumes a rational allocation among such major outlets as processing and domestic and foreign fresh citrus markets. Further, through the pro rata system, marketings are adjusted during the marketing season.

It may be argued that a cooperative cannot exercise maximum market advantage unless it can also limit or adjust the production of its members to fit market demands. This raises the legal question of whether or not a cooperative would have such broad authority. Although the answer has not been authoritatively given, there is substantial doubt whether existing laws authorize a cooperative to control production of its members by a direct restriction on output.

The increasing emphasis on vertical integration and coordination in agriculture as considered in relation to cooperatives raises some important legal issues. The Capper-Volstead Act, a Federal Statute, specifically provides "that persons

engaged in the production of agricultural products as farmers may act together in associations, corporate or otherwise, with or without capital stock in collectively processing, preparing for market, handling and marketing . . . such products of persons so engaged." This Statute further states certain restrictions, "Provided, however, That such associations are operated for the mutual benefit of the members thereof, as such producers, and conform to one or both of the following requirements:

"First, That no member of the association is allowed more than one vote because of the amount of stock or membership capital he may own therein, or

"Second, That the association does not pay dividends on membership capital in excess of 8 per centum per annum."

And in any case to the following:

"Third, That the association shall not deal in the products of non-members to an amount greater than such as are handled by it for members." There is the further limitation in the Act "That if the Secretary of Agriculture shall have reason to believe that any such association restrains trade . . . to such an extent that the price of agricultural product is unduly enhanced he shall serve upon such association a complaint stating his charge. . . ." The procedure and action to be followed by the Secretary is then prescribed. Essentially, this gives the Secretary of Agriculture the power to prevent any undue enhancement of prices.

Students of cooperative marketing believe that the fundamental objective of the Capper-Volstead Act was to permit farmers to unite in voluntary organization to act with the same force and effect as though all the products of all the farmers so united were being handled by one farmer.

Thus, when a cooperative operates along normal business lines,

control of the entire supply of a given agricultural product would not, of itself, cause the cooperative to be in violation of the antitrust acts. However, abnormal conduct on the part of an association might subject it to the antitrust laws and the jurisdiction of the Justice Department. It should also be emphasized that in its normal business conduct a cooperative must abide by all other laws that may be appropriate. For example, conduct constituting unfair competition would be subject to jurisdiction conferred upon the Federal Trade Commission.

A distinction must be made between vertical integration in itself and the use of vertical integration by the cooperative to affect its competitive role in a market. The Supreme Court recently ruled on a case involving a dairy cooperative in a large metropolitan area that had acquired a noncooperative dairy processing plant that was supplied by non-members (19, 44). The cooperative in its other operations acted as the bargaining agent for its members and did not physically process and distribute their milk.

The Court ruled in favor of the lower Court which found that the motive for, and result of, the acquisition was basically to eliminate or reduce competition rather than to achieve greater efficiency through vertical integration. The cooperative was ordered to divest itself of the acquired business. This again emphasizes that cooperatives must conduct their business affairs under, and generally abide by, the same rules of conduct that are applicable to other types of corporations.

Cooperative purchasing associations have served to counter monopolistic practices which farmers believed certain suppliers were exercising. Feed milling, fertilizer manufacturing and oil refining are some earlier supply stages into which agricultural cooperatives have integrated. In supply coor-

dination, relatively greater emphasis has been placed on gaining economies of operation, providing additional services and improving quality of inputs.

Contract Production

As defined earlier, contract production is a distinct business arrangement under which one firm agrees to produce for another firm. The firms maintain their separate identities and long-range profit objectives. Contracts differ in several ways: (1) In the degree to which both parties participate in management during the production process; (2) in the method of payment for the product or service produced; (3) in how risk and profits are shared; and (4) in whether one or both parties supply resources used in production.

A production contract binds successive stages of the participating firms, and the market for such contracts replaces the former markets for the completed products and services. It is sometimes said that production contracts bypass the open market, but this is not always true. It may often be a replacement of one type of open market by another more efficient one. Contract coordination may achieve results similar to those under true vertical integration. But contracts commit the coordination for a specific period of time only, and new capital investment is usually smaller than when production of the coordinated stages is undertaken within a single firm.

For these reasons, the degree of market control possible under contracting will differ from that under vertical integration and will vary by commodities and circumstances. The fact that farm production contracts are usually not made for longer than one season permits sellers or buyers to change the parties with whom they deal if more favorable opportunities arise. Similarly,

farm contracts carry fewer long-run investment commitments that strongly tie together production stages of separate firms.

Compared with integration, it would be somewhat easier under contracts for new firms—either buyers or sellers—to provide the capital needed to enter the market and thus reduce any market advantage that others might have. For commodities customarily produced under contractual arrangements, producers without contracts may have difficulty finding a market or receiving reasonable prices, and noncontracting buyers may have difficulty finding uncommitted supplies to buy. Thus, in production of broilers, peas, sweet corn, and tomatoes for canning, contracts are almost essential to operation. But much of the market advantage here is temporary and incidental to other reasons for contracting.

Some vertical contracts in industry may permit a considerable degree of market control. But to accomplish this, the contracts usually involve horizontal integration, and often commit capital for relatively long periods. An automobile manufacturer may make loans to, or investments in, the business of a parts supplier and give a long-term contract. The magnitude of the order may be such that the entire output of the supplier is controlled to the exclusion of other buyers. Through dealer-agency contracts, automobile manufacturers exert much market influence by excluding automobiles and parts of other manufacturers from that particular market outlet. Even though the legal enforcement of such exclusionary contracts is questionable, they may be practically effective. Other long-term contracts such as a mail-order firm might make with a product supplier may result in as much market control as though the supplier firm were acquired by the mail-order company.

Lengthening the term of contracts may tend to influence markets and prices for farm products. But to be very effective, the volume of production under contract would need to be large relative to the market involved. Also, because of the ease of entry into production of most farm products, any important degree of market control would require monopolistic or oligopolistic ownership of the facilities of some critical stage such as processing. In sugar beet production, for example, contracts are made between producers and processing companies. But the contracts are not the main reason for the year-to-year stability of prices paid for sugar beets. Any influence on prices results from the strength of sugar beet growers bargaining associations and the barriers or incentives to sugar beet growing, such as government quotas and payments and limited processing capacity.

The Commercial Broiler Example

Some further consideration of market advantage possibilities in the broiler industry may be helpful because of its prominence in recent history. Contract production at the growing stage is still the most common arrangement, although integration with dealers or processors is also significant. Sharp differences in the interpretation of the competitive situation in broilers are found among analysts of the broiler industry. In his 1960 discussion of a paper by Henry and Raunikar, Roy said that he "leans more and more to Stigler's hypothesis that regardless of vertical integration, perfect competition may still come closer to describing the situation than any other type of market structure, especially in broilers, where horizontal integration at its worst has yielded the leading firm in the USA with only 2 to 3 percent of the total national supply" (53).

Yet even Roy recognizes various degrees of concentration of firms at different stages in the broiler complex, although he regards the 7 breeder firms that provide most of the foundation stock for producing hatching eggs as the only extremely concentrated stage.

The truth may be that the market advantage potential in the market structure for broilers has been masked by the dynamic changes that have been going on. The rapid growth of the industry, the steady stream of new technology, together with expanding market demand, have been more significant factors. But these forces will inevitably taper off as the industry matures, and there is a strong possibility that they will taper off unevenly, leaving a situation not unlike that in other farm commodities—a state of chronic surplus supply. Or at least, the resources available to go into production on short notice will be excessive. If this proves to be so, the existing market structure will lead to a different conduct and performance in which the exercise of market advantage will be more apparent.

Independent production without a contract has not been feasible in most broiler areas for some time. The small grower must have a contract. In an expanding industry, contractors may compete for growers and contracts may be easy to get. But in a mature industry, the contract is a ticket of entry which may be granted or denied by the contractor on his own terms. Assuming that growers do not organize nationally to provide countervailing power, or obtain a Federal program, their freedom of entry, prices, and output are subject to the decisions of the

contractor. How serious this is to producers depends partly on the extent of their investment and credit commitments and on what other economic alternatives are open to them in the economy at large.

Differences in market structure in different producing areas may also influence market advantage. In Maine, where the processors do the contracting and have integrated into the feed supply stage, the contractor might have more control over growers than in the Delmarva area, where the live broiler auction market between the growing stage and the processor provides an important outlet.

Market advantage as reason for integration or contracting in farming may be less significant than other motivations, but it is likely to be a factor in many continuing situations. Perishable farm commodities that require early processing appear to be more susceptible to concentration in numbers of firms, to product differentiation, and to changes in other structural elements that lead to imperfections in competition and to market advantage. Control of conditions of entry and exit may be important elements in this context.

The persistent presence of surplus capacity and resources at the farm level also has an important bearing on what happens under any given market structure. When the exit of such resources is blocked, the individual farmer's bargaining position is weakened and other aspects of market structure may give the processor who contracts more influence than otherwise. In this and many other ways, market structure considerations may be of considerable significance.

CHAPTER 5.—RISK AND UNCERTAINTY

A great deal has been written on risk and uncertainty in the last 20 years. It is a subject with wide ramifications throughout many phases of theoretical and applied economics. But despite the considerable attention that has been devoted to analysis in this field, comparatively little thought has been given to the relationships between uncertainty and vertical coordination. Yet the presence of risk and uncertainty is one of the reasons frequently advanced in explanation of vertical integration and contract farming.

First, what are risk and uncertainty? Usually there is little misunderstanding as to the meaning of the word "uncertainty". It refers to future outcomes that cannot be predicted closely enough to establish probabilities. Individual farmers face much uncertainty in their expectations of production costs, output, and prices. Knowledge of the future is not perfect. The word "risk" is often used to mean hazard. A risky business popularly implies danger of financial loss. More precisely, however, to follow Frank Knight (36), risk is used where the probabilities are known. Risk can be closely estimated for random events in which relatively large numbers or long periods of time are involved.²⁷ If the risk of loss is

known, it can be treated as a certain cost.

In some respects, the analysis of risk and uncertainty is simply viewing all economic activity from the special angle of the risk-bearing function. One cannot organize and carry on production with all of its decisions without incurring risks and being uncertain of the outcome. A firm cannot avoid facing uncertainties, but it usually tries to minimize hazards if this will increase profits, or if the consequences of an unfavorable outcome are considered too serious.

Uncertainty arises partly from lack of knowledge and partly from the impossibility of knowing the future. More information will help to cure lack of knowledge, but the other kind of uncertainty needs to be offset in other ways.

Farmers are concerned with many risks and uncertainties. These range from personal fortunes to the actions of people with whom they deal, and from weather to government programs. Uncertainties of production and prices are basic. There are uncertainties as to prices of inputs as well as prices of output. Modifying these basic uncertainties are others, such as those relating to specialization, new technology, size of operation, market outlets, availability and cost of capital, and asset and debt position of individual producers.

Methods of Meeting Uncertainty

The way to deal with uncertainty depends upon the nature of the uncertainty and whether it is a random or a sporadic occurrence. If

²⁷ Despite the useful distinction thus made between risk and uncertainty, the English language is so flexible an instrument that it is difficult to capture and confine a word in a cage of one meaning. The common use of risk in the sense of hazard is so deeply imbedded that it may not be worth the trouble of insisting on the economist's definition on every occasion.

the phenomenon is a random, repetitive type, it may be possible to convert the uncertainty to a measured risk that can be treated as a cost. This is the type of event that insurance can deal with. Fire insurance and hail insurance, for example, cover risks that are predictable in the aggregate, although not for a particular farm.

Price fluctuations are not so random as to lend themselves to the insurance principle and strictly speaking, price insurance has not proved feasible. But hedging on organized futures markets is a way of providing against some of the uncertainties of future prices for certain commodities.

At the level of the firm, a number of flexible devices have been used for offsetting or reducing uncertainties within the firm's operations. Among these are using storage reserves, keeping surplus power and equipment against the need for peak emergency use, using unspecialized equipment capable of other uses, using techniques with a high percentage of variable costs, and keeping durable items in smaller scale multiple units.

Diversification in products, in geography, in time, or in other ways is another way of averaging uncertainties that might strike heavily in one place.

Dealing with uncertainty is thus clearly connected with technical aspects of production as seen from within the firm. By various means, each costing something, a considerable range of flexibilities can be introduced to avoid or reduce the adverse effects of uncertainty.

Procedures outside the firm, such as insurance, hedging, and contracting, are structural devices for shifting hazards to specialized institutions. By horizontal extension, these institutions can gain the advantage of large-scale operation. This may not be possible for the individual producing firm, even though it may be efficiently orga-

nized with respect to all other vertical stages in its control. This treatment makes a particular kind of uncertainty a specialized stage that is separated from the farm and handled by a specialized firm.

How does a farmer or businessman determine whether it is better to carry risk and uncertainty within the firm or to make use of the services of an outside institution? Obviously, this depends upon how seriously a loss might affect the business and then upon the relative cost of providing a desired level of protection in alternative ways.

Maine potato growers have made some hedging use of the New York futures market for potatoes to protect themselves against seasonal changes in potato prices. The hedging operation helps them in financing cash costs and assures their creditors of payment.

Many moderate-sized cattle feeders in the Midwest feed cattle on contract for larger operators. Cattle feeding involves uncertainty as to price movements, and the small or moderate-sized operator who does not have large financial reserves does not always want to take the chance of a heavy loss. Feeding under contract assures him of a relatively certain return. Large contractors usually have stronger financial backing and are able to spread their hazards over time and larger numbers.

Similar conditions prevail in broiler production. Here, heavy cash costs, wide price fluctuations and high perishability could result in serious loss for small producers who market broilers only a few times a year. Contracts or substantially expanded operations may reduce this uncertainty.

Vertical Contracts and Uncertainty

Uncertainty and vertical contracts are discussed here mainly from the viewpoint of farmers. Proc-

essors and farm suppliers often are just as eager to reduce uncertainties. But in initiating contracts they may assume additional hazards in exchange for other production or market advantages. Stabilizing prices is often important to processors and other users of farm products but dealing with other uncertainties may be even more important. Processors, for example, want to be certain of a given flow of farm products to keep their plants, equipment, and labor operating at optimum efficiency. A definite quantity and quality may be needed to meet market commitments. Contracts are vital in coping with these uncertainties, especially when perishable and specialty commodities and limited markets are involved. Farm suppliers sometimes must share some of the uncertainties of farm production through contracts if they are to reduce market uncertainties for the farm inputs they supply.

Price and Market Uncertainty

Price and market uncertainty is one of the reasons for farm production contracts. The level of prices is a major uncertainty in most farm production and one might well ask why contractual arrangements are customary with some products and not with others.

If we look at commodities for which there are few contracts, such as corn, wheat, rice, cotton, hogs, and beef cattle, we find large-scale, well-organized markets. Each farmer usually has several possible outlets through which he can sell his product. There is sufficient trading so he need not depend upon a single market. Further, these products are less perishable than those contracted, and the need to assure a market for a particular point in time is less urgent. Processing of these commodities need not be done immediately. "Rough rice must be

milled to remove bulk, but rice is not highly perishable; consequently growers have more flexibility in arranging marketing outlets. Cotton must be ginned, but numerous gins are available and the harvest season is reasonably long; consequently few definite arrangements are made in advance. Even for livestock, which are ordinarily marketed through an agent, some flexibility exists in the time and method of marketing" (29).

In contrast to storable commodities for which there is a broad market, consider the uncertain price situation that farmers would face if they were to attempt to sell broilers, canning peas, or sugar beets without making arrangements for sale before production. Such commodities must be processed at a certain time for best quality. Few producers are willing to take a chance on finding a market within the short period available after production has been finished. With variations in production, prices would fluctuate widely at market time if contracts were not made. In some years, they would reap large profits; in others, heavy losses.

A second group of commodities for which unusual price and market uncertainties make contracts desirable is that of specialty products. These include a variety of minor crops and livestock products and seeds. Contracts are necessary because markets are limited and frequently not very competitive. Castor beans, safflower, mustard seed, oriental tobacco, spider silk, goat's milk, and frogs for biological laboratories are a few examples of minor products. Vegetable seeds, hybrid seed corn, and baby chicks are examples of specialized genetic enterprises. The uncertainty of finding a market at reasonable prices for these specialty commodities would be especially great under open production.

Production and Technological Uncertainties

Contracts reduce uncertainties of production by disseminating information concerning improved plant and livestock varieties and new cultural practices. The supervised education provided under contracts has a built-in economic incentive that is stronger and more effective than that provided by the usual extension teaching methods. The contractor often provides inputs of high-quality seeds, feeds, animals, and medicines. In many instances, the contractor closely supervises farm production. Under contracts, the mortality rates in producing broilers and turkeys are substantially reduced and conversion of feed to meat increased. Some of the reasons advanced for hog contracts are that under them the mortality rates of baby pigs are reduced, a meat-type hog is produced, and more efficient feeding is promoted. In contracts for production of sugar beets, processed vegetables, seeds, and specialty crops, the main objective is reducing uncertainties of type, quality, and delivery time. Contract arrangements are especially valuable in increasing certainties of production when new technology, improved products, or inexperienced producers are involved.

Not all production uncertainties can be eliminated by contracts. Existing knowledge or technology can do little to prevent many hazards of weather, accident, or disease. Under contracts many of these residual production risks are borne by the producer. Ordinarily contractors do not pay for lost production. But when the contractor supplies and owns inputs used in production of some commodities he stands the loss of such inputs in the event of reduced yields or heavy mortality.

Capital and Credit

In the production of broilers, turkeys, eggs, and hogs, contractual arrangements often reduce the uncertainties that producers face in obtaining adequate operating capital and in repaying debt incurred for such purposes. Because of inexperience or low net worth, many individuals cannot get credit from customary bankers and lenders. By guaranteeing a market and reducing production uncertainties through improved technology and supervision, contractors can place capital in the hands of producers with relatively little chance of loss. The working capital with which the producer operates is owned by the contractor; it does not legally constitute a debt that must be paid regardless of income. Participation by the contractor in production and marketing makes it easier for the producer to obtain any needed credit from more usual lenders for buildings and equipment.

In such contract crops as lettuce and green peas, the contractor often provides labor and specialized equipment for harvesting. If it were not for contracts, the uncertainties of obtaining these inputs might prevent many growers from producing. In some instances, the labor and equipment needed is provided on credit to be repaid from the crop proceeds. In others the harvesting stage is simply transferred from the producer to the contracting firm.

In the contract production of many crops, capital and credit play a minor role. Small amounts of credit are supplied to the producer in the form of seed, plants, or spray materials. These advances are mainly for purposes of convenience or standardization. The capital involved is so small that few producers have difficulty in supplying it, either from their own funds or with loans from the more usual

sources. Repayment of such advances also presents few problems.

Differences Among Contracts in the Transfer of Uncertainty

Contracts differ greatly in the extent to which uncertainties are transferred from the farm to the contracting firm. Under the classification scheme discussed in Chapter II, as more uncertainties are shifted from farmer to contractor, the contract moves away from open production and toward complete vertical integration. The aspects of risk considered in this classification are primarily those uncertainties encountered during the contract period. The characteristics and availability of contracts in subsequent production periods are not treated here, although they may be of great long-run importance.

In open production the producer assumes all the hazards. He stands all losses; he also benefits from any favorable outcome.

In market-specification contracts the producer assumes the usual hazards of production but is assured of a market if his output meets specifications. In most instances, the price he will receive or a price formula is stated in the contract. The producer retains profits resulting from favorable production but forgoes profits that might arise if market prices were more favorable than contract prices.

Production-management contracts involve commodities with requirements for quality, scheduling of deliveries, and related matters so strict that advance specifications alone are insufficient. The contractor copes with these additional uncertainties by participating in farm production decisions.

Under resource-providing contracts market and price uncertainties for the finished product assumed by the contractor take on added meaning because of investment in such inputs as feed, chicks, or other

livestock. Producers are usually certain of receiving a specified price per unit of product. Thus, major uncertainties are transferred to the contractor. The producer still carries part of the production uncertainties related to volume. For example, if an animal dies, or a crop fails to mature, he receives no payment. Most profits belong to the contractor, although many contracts permit additional or bonus payments to producers.

Under vertical integration the single firm, of course, bears all the losses and claims all of any profits. Such an integrated arrangement might involve a processor buying or leasing a farm and paying a former farmer a wage for producing. The rental and wages would be paid regardless of production and prices, and all net returns would be retained by the integrator. Thus, a farm operator who wished to be relieved of the most uncertainty would seek to sell or lease his farm to another firm and become a hired hand.

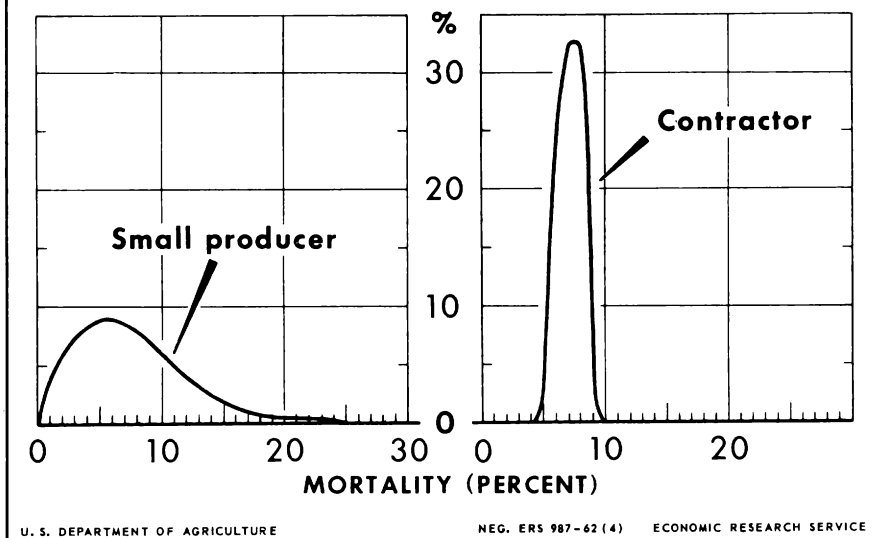
Examples of Reducing Uncertainty Through Contracts

The history of commercial broiler production is interesting with respect to the importance of uncertainty and the role that contracts played in dealing with it. Here, one of the chief reasons for the development of contractual arrangements was the high degree of income uncertainty that faced small independent producers. Feed dealers and other contractors proved to be better able to cope with the uncertainties and to continue to supply the necessary resources.

Disease and heavy mortality of birds originally constituted the main hazards. Even in the late forties, death losses of broilers in Delaware were frequently as high as 40 percent for some producers (42). Since that time, the losses from disease have been greatly reduced,

EXPECTED MORTALITY OF BROILERS

Frequency Distribution, Early 1950's



U. S. DEPARTMENT OF AGRICULTURE

NEG. ERS 987-62 (4)

ECONOMIC RESEARCH SERVICE

FIGURE 10.—The mortality expectation curve is relatively wide and low for the small producer; high and narrow for the contractor.

and in recent years, prices have constituted the major source of uncertainty. In 1957, average weekly prices of broilers in Delaware varied from a low of 14.5 cents a pound to a high of 20.3 cents. An individual broiler producer might be unlucky enough to experience heavy mortality or be obliged to market his birds during a period of low prices. A feed dealer with many flocks under contract is more concerned with average mortality and average prices for the entire year. These averages can be estimated with greater certainty than can the production of a particular producer or the price during a particular week.

To show the difference between a feed dealer and a small producer in the way they view the uncertainty of mortality in growing broilers we have constructed judgment probability curves for each. These curves are based on data

obtained by Frank Hansing for 180 flocks produced in the last half of 1952 in Delaware.²⁸ The mortality among these flocks ranged from almost zero to more than 30 percent. This experience indicates that a mortality expectation curve for an individual producer based on that period would be relatively wide and low, skewed to the right, and with a modal frequency of about 6 percent mortality (fig. 10). The curve indicates a probability that in 1 in 4 flocks the mortality would be 10 percent or more, and that in 1 in 20 flocks it would be 20 percent or more. The chances of experiencing these higher losses, even though small, would influence producers to seek arrangements that would make returns more certain.

In contrast to the producer's situation, a probability curve as viewed

²⁸ Unpublished data from study reported by Hansing (27).

by a feed dealer would be high and narrow. The uncertainties that confront the individual producer would disappear in the average. The uncertainty that faces the feed dealer is with respect to the level of the annual average. The average mortality for 180 flocks during the last half of 1952 was 8 percent. In the subsequent 3 years, the mortality averaged 7.1, 8.0, and 6.2 percent respectively. This suggests that a dealer with a large number of flocks under contract would have expected with much certainty, at that time, that the average annual mortality would not vary from year to year by more than 2 percentage points. In effect, what was a major uncertainty to each individual producer was converted by the contractor into something more like a smaller calculated risk. A calculated risk is just another cost of doing business.

The difference between individual producers and contractors in ability

to cope with fluctuating broiler prices is similar to the difference in meeting the uncertainty of mortality. The individual who produces 4 lots of broilers in a year must look at the probabilities of marketing his birds at various prices. For example, average weekly prices in Delmarva for 1957 ranged from a low of 14.5 to a high of 23.0 cents per pound. The probability of an individual producer marketing his broilers in that year at 17 cents or less was the same as the probability of receiving 21.5 cents or more (fig. 11). On the other hand, a feed dealer who keeps up with price trends and operates on a large enough scale to market his broilers continuously throughout the year might have been able to predict his average sales price within 2 or 3 cents.

Lettuce growing in the Salinas Valley of California furnishes another example of the use of contractual arrangements to cope with serious disease hazards and price

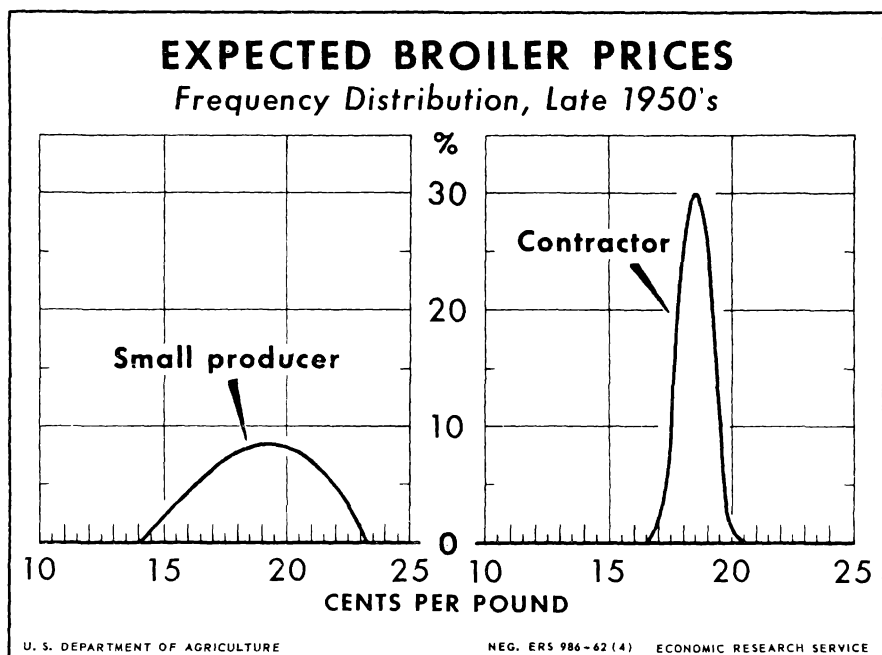


FIGURE 11.—The price expectation curves, like the mortality expectation curves, are typically different for the small producer and the contractor with many flocks.

fluctuations. Here operations have been put on an actuarial basis by those dealers who are equipped to ship every week and who have entered into contracts with growers to produce under large scale, low-cost conditions with guaranteed minimum returns. Lettuce growing in the Salinas area could not have expanded as it has if the problem of uncertainty had not been met (35).

Costs of Reducing Uncertainty Through Contracts

The cost to farmers of reducing risk and uncertainty by means of contractual arrangements or vertical integration is difficult to estimate. This is one area in which further research is needed. It is mainly a matter of measuring the advantages and disadvantages of the arrangements, and of estimating profits and losses under different methods of production.

To the extent that the production and marketing systems may be coordinated more smoothly under contract or vertical integration, there may be no real increase in cost. It is apparent that for some commodities the more stages toward the consumer that are integrated the more nearly perfect is demand information at the production stages. Even without contracts or integration through to the consumer, a contractor or integrator operating on a large scale might be expected to keep up better with market changes than would small independent producers. Costs of reducing individual uncertainties by pooling them through a contractor should be low.

Elimination of uncertainties about capital supply, factor prices and product prices has a value for which many producers are willing to pay in the form of reduced prices. But even here, the contractor may be willing to assume additional hazards without a commensurate charge to the producer because of profits made possible at other stages

in his business. Further, the producer may pay an uncertainty cost for each unit produced but because the reduction of uncertainties permits more efficient operation on a larger scale, his total uncertainty cost may be less than before.

In production of such commodities as broilers and eggs for which technology, producing areas, and market conditions change rapidly, perhaps the major risks are those arising from the short-term nature of contractual arrangements. Here, there are uncertainties as to renewal of contracts on favorable terms. This can be a serious financial hazard when the entire income of an individual depends upon a contract, especially if investment in equipment and building has been made in anticipation of continued opportunities for contract production. Arrangements that spread improved technology rapidly and expand aggregate production may present longer run risks to areas or individuals not participating in them. For example, areas of the South that are expanding contract egg production are providing strong competition to the Midwest. In some areas, contracts have so greatly changed market outlets that the risk of producing eggs, broilers, and many vegetables for processing without a prior market commitment is very great.

Complete Vertical Integration and Uncertainty

Small farms that are largely self-sufficient or that sell a variety of products may be little troubled by uncertainty. But these highly integrated farms are inefficient and are passing from the scene.

The long-time trend in American agriculture has been toward fewer and fewer stages or processes of production on farms. It has been found more efficient to specialize in certain enterprises and certain stages and "disintegrate" other

stages to the supply or marketing systems. But with specialized farming, uncertainties of both production and price may increase. Price uncertainties may be especially large. Market prices for a single product often fluctuate widely. When many production stages or inputs are purchased, factor prices and cost can vary greatly.

As discussed in the preceding section contracts for the purchase of inputs and for the sale of products may constitute a substitute for diversification, either horizontal or vertical. In some instances they permit farm firms to specialize and get the economies of volume production without the uncertainties associated with capital investment.

Complete vertical integration on a large scale with marketing, processing, or supply businesses is

another device for reducing uncertainties. The farmer-producer may enlarge his operations and become the entrepreneur of the integrated firm, or he may sell or lease his farm to the larger business and perhaps continue on a wage basis. In that event he becomes certain of a given income for the wage period.

The large integrated firm may convert uncertainties to calculated risks as effectively as a contract system. Supervision within the integrated firm may also permit closer control of production. Concerns which have integrated into production have indicated that they were able to reduce costs, improve quality, and align output better with other stages, especially with the processing plant. Under integrated operations uncertainties as to capital inputs and market outlets may be substantially reduced.

CHAPTER 6.—FINANCING FARM RESOURCES

Specialization and Investment by Farm Firms

Physical resources used in farm production in the United States have expanded greatly during recent decades. Between 1940 and 1962, the total value of farm production assets in 1947-49 prices increased about 30 percent. Inputs of power and machinery, feed, seed, and livestock purchases more than doubled during this period and fertilizer inputs more than tripled. In contrast, inputs of farm labor decreased by almost half. Accompanying these changes have been important increases in output per acre, per animal breeding unit, and per man-hour.

The bulk of the fixed assets and variable inputs used in agriculture are owned and provided in the traditional way by farm operators and nonoperating landlords. In some instances, farm machinery and equipment are leased by farmers. In others, resources are owned by nonfarmers who perform custom services for agriculture. Financing of farm resources, other than from income, is mainly through the Nation's banking and credit system. Total farm debt owed by farm operators and landlords was nearly \$28 billion at the beginning of 1962, more than 2.5 times the debt of 1940.²⁹

Processors of farm products and suppliers of farm inputs are other

sources of farm capital that are growing in importance. Some provide inputs on credit to farmers but others invest directly in the farming business. Processors and suppliers often are large relative to farm firms. Not only are they backed by their own financial strength but they also divert substantial amounts of credit into farm production from the banking system. However, no specific estimates of the volume of this credit are available.

We are concerned here with investment decisions of both farm firms and the nonfarm firms that deal with agriculture. For most farm commodities, there are many stages of production from the supply of raw material inputs to the consumption of the end product. The interfirm arrangements for financing farm production are of particular interest to us.

The most efficient employment of available capital and resources is an important function of a firm seeking profits. Should the firm invest in many vertical stages or should it expand horizontally in a few stages, buying most of its inputs and selling to others for later processing or marketing stages? The stages included or financed by a firm will depend upon the entrepreneur's knowledge of profitable opportunities, managerial and technical competence, and attitudes toward risk and financing. The capital and credit available to firms and the competitive nature of the markets in which they operate are also important in influencing their investments in productive resources.

Let us first examine the situation of firms for which the main business

²⁹ Net income from agriculture and value of farm assets also rose during this period by more than 2.5 and 4 times, respectively. The volume of new credit during the year would indicate more accurately the importance of financing by the banking and credit system. But an estimate of the amount of such credit has not been made.

is farming and whose operations involve open production under the control of farmers. Next, let us look at the resource and financing aspects of production contracts made between farmers and such contractors as farm suppliers and processors. Finally, let us review situations in which suppliers, processors, and others integrate into farm production stages.

Enlargement of farms and growth of output have been significant developments of the last two decades. This has been mainly a horizontal expansion, and in some instances, a narrowing of the vertical scope of present operations of individual farms. Apparently, operators of farm firms believe that the capital and resources used in the farm business can be more efficiently and profitably employed at relatively few stages of production than if they are spread into more vertical stages, either forward or backward. In fact, in the trend toward greater specialization, farm firms have withdrawn from certain vertical stages which for reasons of technology could be included more efficiently in the operation of other firms. Farmers are buying more of their inputs of feed, young stock, and power, and even such services as hay baling, grain combining, and livestock insemination. On many farms, these inputs can be bought more cheaply than they can be produced. Thus, the number of internal stages or processes of production that some firms need to finance is reduced, although the total financing may not be less.

The decisions that farm firms make relative to the use and financing of productive resources are influenced in varying degree by the firms with which they deal. Lenders and dealers who make loans or provide supplies on credit may have a very direct effect upon the resource program of farmers. But such influences on capital considerations may be minor under condi-

tions of open production as compared with situations in which a farm firm makes production contracts or becomes vertically integrated with a supplier, processor, or marketer.

Financing Under Integration and Contracting

Integrators and contractors are influenced by much the same factors when considering investments in farm production. Both as processors and marketers of farm products, they depend upon the output of agriculture as a preceding stage. Even when the nonfarm business is a supply firm that integrates or contracts with farming as a forward stage it sometimes markets or processes the output of that stage. In their vertically forward position, nonfarm firms usually want to be certain that the needed farm product will be available in uniform and in adequate quantity; and at a reasonable price. For many farm products, farmers meet these requirements through ordinary production for open markets. Farming is an industry in which there are many producers; uniform grades and standards exist and the product is often a homogeneous one.

Under these conditions, there is little incentive for businesses to invest in farming. Usually, as indicated earlier, they can get greater returns from alternative investment opportunities by using available capital to expand horizontally in their own stages of production, or to expand vertically toward the consumer when some advantage may be gained in less competitive markets. Some firms may prefer to use available capital to integrate into unrelated product lines to diversify risk. Such integration is called lateral and conglomerate integration.

Thus, financing of farm production by nonfarm businesses—either under contract or vertical integration—is mainly necessary only when

open production fails to achieve the market outlet or procurement objectives of these businesses. Such financing might mean expansion of sales of farm supplies to farmers or increased availability to marketing and processing concerns of farm products of the proper specifications at reasonable prices.

Financing Under Contracts

Feed and fertilizer firms, hatcheries, gins, canneries, and other suppliers and processors are among those who furnish resources to agriculture under contractual arrangements. These businesses, which may be private organizations or cooperative associations, are commonly called the *contractors*. They provide a variety of operating capital including such items as seed, feed, fertilizer, chicks, pigs, medicine, and equipment. They furnish a number of services, ranging from general managerial guidance to such specific tasks as pruning, spraying, harvesting, and hauling. Often, the contractor retains ownership of the capital he furnishes and becomes a joint operator with, rather than a creditor of, the farmer. The *producer* usually means the operator of the farm and he may be either an owner or a tenant. Sometimes, however, as in broiler production, the contractor may be more nearly the real producer, if he owns much of the operating capital and exerts a considerable measure of entrepreneurial control.

The land, buildings, equipment, and labor used in contract production are usually provided by the farmer. He may also supply some of the operating capital. How much of the different resources the farmer supplies varies with the commodity and the type of contract. If he needs credit to provide for the cost of the items he furnishes, he may borrow from commercial banks, insurance companies, Federal land banks, or production credit associations.

The discussion in this section relates mainly to the resources supplied directly to producers by contractors. Perhaps of equal significance is the indirect effect of contracts on the capital and credit used in farming. Regardless of the resources supplied under the contract, the contractor provides a market for the farm product and reduces the price uncertainty. Producers become more willing to invest their own capital and labor and to borrow for additional resources; the credit rating of the producer is improved in the eyes of lenders. For example, few lenders would extend credit to a fluid milk producer if he did not have an agreement with a distributor or processor to take his milk. In some instances, contractors may help producers negotiate loans with banks and production credit associations for buildings and equipment.

Under some arrangements, contractors provide no resources to the producer. Processors and buyers can fill their requirements for agricultural products by agreeing in advance with producers to buy products of certain specifications. In these situations, the specifications set by the buyer may not be exacting and can be easily determined by grading and inspection. The producer is willing and able to cope with the production risks. Further, producers under these contracts usually can finance their operations in the conventional way and need little managerial or technical guidance. As suggested above a forward contract always improves the credit standing of a farmer and gives him better access to customary lenders.

Contracts that provide materials or services to producers directly may be roughly divided into two classes: (1) Those involving small amounts of financing by the contractor; and (2) those involving heavy financing by the contractor.

Light Contract Financing.—Let us first consider production contracts in which the contractor provides small amounts of resources to the producer as an inexpensive way of assuring quality and uniformity. These resources include seeds, plants, baskets, and specialized cultural or harvesting services. Quality specifications for canning peas, hybrid seed corn, and sugar beets, for example, are important and sometimes difficult to determine by inspecting the final product.

The processor may advance the inputs on credit and deduct payment upon delivery. Or the inputs may constitute an investment by the contractor, the cost of which is considered in setting the contract price. But whether they are credit advances or investments, financing in this kind of contract is primarily a means of implementing the terms of the contract rather than expanding the market for the goods or services supplied to farmers. Nor are the capital requirements and risks involved in this group usually beyond the capacity of the individual producer. The product under contract may be only one small enterprise in the farmer's total business.

Lower cost may be another advantage of contractor-supplied inputs. By providing inputs to a large number of farmers, the contractor may be able to gain the advantages of scale that would not be possible for each individual producer. These savings may benefit both contractors and farmers. For example, a sugar beet company supplying seed or a canner providing tomato plants to many producers can do so at relatively low unit cost. The harvesting of green peas by modern equipment is economic when done by the cannery for all its producers; ownership of such equipment would not be justified for the average pea producer.

Heavy Contract Financing.—Leading examples of commodities requiring heavy contract financing are broilers and eggs. Price and production risks are high and farmers hesitate to undertake this production if they must be responsible for assembling the productive resources. In studying the broiler industry in Delaware, Frank Hansing found that even those producers who could raise the money to produce independently did not want to accept the hazards (27). Contractors must provide the bulk of the variable inputs as one of the incentives to producers.

Feed dealers and manufacturers—important contractors in this group—are interested in expanding their market for feed. Originally, feed was sold on open-account credit. But by the mid-1940's selling feed on credit to broiler producers became unsatisfactory. Many accounts receivable became uncollectible and feed sales begin to dry up. Uncertainties of production and price were too great for producers to continue on this basis. Dealers found, however, if they assured a minimum return to producers and provided the necessary chicks and feed, they could expand the markets for feed. They expanded markets even more by moving into the South where labor for building poultry houses and growing broilers was not fully employed. Growers provided labor and buildings, and the feed industry provided chicks and feed.

Examples of Heavy Contract Financing.—In addition to broilers and eggs, hogs may be subject to heavy contract financing. In the Southeast, for example, a broiler contract might provide \$18,000 worth of feed, chicks, medicine, fuel, litter, and other supplies each year in a typical operation of four lots of 10,000 birds each.³⁰ For a 2,000-

³⁰ The estimates of costs used in this section are approximations based on information from published and unpublished sources. For further discussion see (34).

bird laying flock, the contractor's advances in pullets, feed, and supplies would amount to more than \$12,500 a year. The contractor's stake in the breeding stock for a 24-sow-and-boar contract would amount to about \$1,700. Frequently also, he provides corn and supplement worth \$6,000 or more annually.

For contract farms in the aggregate, we do not know how much additional operating capital has been made available in recent years. So far as the greater Southeast³¹ is concerned, the value of feed, chicks, and miscellaneous supplies provided by broiler contractors and integrators in 1959 is estimated roughly at \$350 million. This represents about 40 percent of the value of all feed and livestock expenditures in the region. In 1940, the amount of broiler financing by contractors probably was less than \$10 million.

For the farmer, investments needed to meet the contract requirements may include new or remodeled buildings, machinery and equipment, and some of the operating expenses. Cash costs for constructing buildings may be considerably less than the investment value because farmers frequently use their own labor and farm-produced lumber.

The cash investment in a 10,000-bird capacity broiler house might be \$5,000 or more at recent cost levels. For a 2,000-bird laying flock, the producer's cash investment in buildings and equipment could be as high as \$4,000. Out-of-pocket expenses for constructing and equipping the pig parlor and farrowing houses for a 24-sow contract would be \$2,500 or more. The total amount by which the capital investment in these farms has been increased depends upon how much additional

value is estimated for the farmer's own labor and materials used in the construction.

The broiler houses used in contract production and other forms of vertical production in 1959 in the Southeast are estimated to have a cash investment cost of about \$90 million. Assuming \$45 million to be the value of the operator's non-cash investment, total investment costs would be about \$135 million. One way of picturing the sheer magnitude of the physical investment is to say that if these houses were laid end to end they would reach from the Atlantic to the Pacific coast. More than four-fifths of the investment in broiler houses has been made since 1950.

Factors Influencing Contract Investments

Broad basic forces that have encouraged the flow of capital to farming through contracting channels have included technological innovations, expansion of production in the feed and fertilizer industries, growth of retail chains, supermarkets, and other means of mass distribution, and the possibilities of obtaining profits seen by contractors.

In individual situations, the most important fact is that a contract often acts as an "open sesame" to unblock the flow of resources to agriculture. There are several types of situations in which capital expansion is restricted. Some farm operators lack knowledge of profitable investment opportunities or the managerial ability to carry them through. Some operators are reluctant to borrow because of uncertainty about prices or markets and do not wish to take the chance of impairing or losing the equities in their farms. Some operators may be reluctant to borrow because of a misunderstanding as to the value of using credit or because they believe it to be morally wrong. Others may wish to use credit but

³¹ Virginia, West Virginia, North Carolina, Kentucky, Tennessee, South Carolina, Georgia, Florida, Alabama, and Mississippi.

are turned down by the lender on grounds of low-management ability or too much uncertainty as to production or markets.

A production contract often overcomes these obstacles to capital investment. The contractor provides a program with built-in guidance in new technology and management. He also provides price or income guarantees and access to markets. Usually the financing he furnishes in the form of supplies does not create a debt. Therefore, it is more acceptable to farmers who would be reluctant to borrow. Producers are willing to invest more of their own money and labor. They are also better able to obtain loans from regular lenders to finance buildings, equipment, and miscellaneous operating expenses.

Effect of Contract Financing on the Credit System

What effect has contract production had on the traditional agricultural credit system? Does contracting arise in any significant respect because of imperfections in credit institutions? And what new system has been developed to provide resources for farm production? Definitive answers to these questions are not yet available. The system by which materials, services, and money are transferred to agriculture and among its various stages and segments is complex. Some parts of this system have never been fully described and changes are currently occurring. But we do offer the following observations.

Considering agriculture as a whole the new sources of credit and capital may be relatively minor. Most farmers do not have production contracts and many of those who do, obtain few or no resources from contractors. Lenders such as banks, production credit associations, land banks, and insurance companies continue to provide farmers with large amounts of credit.

Even in areas in which the contractor supplies large amounts of working capital, the older specialized farm lenders continue to finance land, buildings, and equipment. Probably, the volume of these loans has tended to increase in areas of contract development. Perhaps this increased production has tended to restrict the expansion of credit in competing areas. But no data on effects are available.

Notwithstanding the large amounts of operating capital received from contract sources, farmers in general have obtained record amounts of financing from regular lenders. Since 1945, non-real-estate loans of commercial banks and production credit associations have increased in most years. By 1961, such loans were more than 4 and 7 times as large, respectively, as in 1945.

Inadequacy of financial institutions as a cause of contract financing does not seem important in the aggregate, although it may be significant in some instances.³² In the instances in which only a few resources are supplied under production contracts, they serve mainly to control quality, assure other specifications, and achieve some cost savings by means of volume. The shortage of financing by the producer is not critical in these instances.

When the resources needed are large, as in broilers, eggs, and hogs, contractor financing may have advantages over lender financing. Without a tie to the contractor, or some corresponding arrangement, many producers would have little

³² The meaning of "adequacy" is a subjective one that varies widely. Considerations of credit demand, profitable use of funds, aggregate product demand, repayment capacity, as well as the ability and willingness of the institution to extend credit, may be involved. The traditional view implied here is that credit financing is adequate if it meets the demand for credit of those who can reasonably be expected to repay the debt without undue participation by the lender in producing and marketing the product.

eligibility for production credit. Operating capital is only one of the needs of these producers. Technical management, supervision, a market for the output, and a guaranteed minimum return need to be provided if the operation is to be economically successful for either the producer or the supplier of capital. These are functions usually considered to be outside the field of credit.

With regard to the more recent contract developments, presumably some of the resources could be financed by credit or by the producers themselves after they gain more experience in meeting specifications and become stronger financially. But market and technical conditions may continue to require close coordination with, and financing by, contractors. In sugar beets and processing vegetables, for which contracts have long existed, the contractor still supplies some resources as a means of quality control.

Inputs of working capital under various livestock contracts, provide new channels through which resources flow to farmers. Some of the capital originates from a new source—the financial resources of supply, processing, and marketing organizations. The feed-manufacturing industry probably is more important than others as a basic source of capital. In addition to their own earnings, feed-manufacturing companies may borrow from large city banks. In turn, the feed manufacturers extend supply credit to the contracting feed dealers. Feed dealers may also borrow from local banks.

In a midwestern study by Phillips, feed companies were asked about the ultimate, or originating, source of capital required to finance contract programs for poultry, hogs, and cattle. "By far the most common ultimate source for this capital is the general operating capital of the manufacturer. This is true

when the contract is written between the dealer and the farmer, as well as when it exists directly between the manufacturer and the farmer. . . . For some . . . programs . . . manufacturers have organized subsidiary financing corporations to handle the integrated programs" (51). Local banks and lenders represented the ultimate source of capital in 8 percent and large city banks in 9 percent of the formal contracts.

Investment Under Vertical Integration

Let us turn now from contract financing to those situations in which processors and dealers need to produce the commodity themselves if they are to achieve the kind and quantity of product needed from agriculture. This involves vertically integrating into the farm stage and making whatever investment in land, buildings, capital and labor resources is required.

When industry has integrated into agriculture, the reasons may be twofold. It may seek to produce a differentiated product through publicizing its "own farms". Or it may seek elements of monopoly control when barriers of entry exist in the form of limited areas of production, limited availability of management and technology, or heavy financial costs. Second, the industry may find it necessary to enter farm production because of the reluctance or inability of farmers to produce enough to meet their requirements. Limited markets, heavy financial needs, and exacting production specifications and the accompanying risks are deterrents to production by individuals. Many of these factors also encourage contract production. When present in high degree or in combination, they result in vertical integration.

Flower seeds and wrapper tobacco for cigars are two crops that are highly intergrated. A discussion of each will show why produc-

tion by industry is advantageous and production by individual farmers disadvantageous.

According to McCorkle and Reed, flower seeds "are produced almost entirely by the seed companies on land they own or lease. The entire supply of domestically produced seeds is grown each year on a few thousand acres. In terms of value, it is estimated that more than 85 percent of the seed is produced in two counties in the central-south coastal areas of California.

"Since total requirements can be met from such a small acreage of seed, it is only logical that individual companies have gone into seed production to achieve close coordination between production and marketing" (43).

The concentration in the flower seed industry is indicated by the fact that "by 1949 five firms, all in California, were growing 75.6 percent of the crop value of the Nation" (9).

"Exacting technical requirements of the production of flower seeds also encourage company production. The need for continuous and exclusive development of new varieties through breeding and selection in order to compete with other companies for the home gardener's interest further supports the growth of seed production by the seed companies. Producer markets comparable to those for other types of agricultural production therefore do not exist" (43).

McCorkle and Reed also state that "Contracting to produce flower seeds has not been prevalent among growers . . . because of the heavy labor inputs, the constant attention required for seed crops of flowers, and the small acreages . . . Major expense items are cultivation and thinning, control of diseases and pests, roguing, fertilization, and harvesting. Expenses of irrigation may also be sizable in some places Total costs . . . may vary from approximately 250 dollars to

more than 1 thousand dollars an acre. Costs are even higher for some crops on smaller acreages that require additional hand labor for pollination."

With regard to shade-grown tobacco for cigar wrappers, cigar companies produce more than half their total needs on their own farms. This is an industry with only a half dozen major users. Production of wrapper tobacco is concentrated in two areas—the Connecticut Valley with about 8,000 acres and an area in Georgia and Florida of 5,000 to 6,000 acres. Quality requirements of tobacco leaf as to texture, color, thickness, and burning characteristics are exacting. This limits production to certain soils and climate and involves specific practices relating to seed, fertilizer, and cultivation. Managerial talent to carry on production is also limited.

Cash costs of production may run to \$1,000 or more an acre. Wire, poles, cloth, fertilizer, plants, several hand pickings of leaves from the stalk, and hand sewing of the leaves to laths for curing contribute to high cost production. Not enough individual farmers, even with managerial and technical capacity, are able to provide the necessary resources for production either from equity or credit sources. In view of high costs and limited markets, few are willing to bear the heavy risks of production and price.

From the viewpoint of the cigar company, the investment of capital in production of wrapper tobacco is more attractive. In the first place, market uncertainty does not exist because all the output of that particular stage of production is used within the firm. Production costs are prohibitive for many individual producers, but they are not too heavy for a large cigar company. Wrapper tobacco constitutes only a small part of the cost of producing cigars and can

be obtained from relatively few farms. This differs from the tremendous capital and production costs required were a canner or packer to produce all the vegetables and meat he processes.

Because of the important barriers to entry and the few producers of shade tobacco the potential for market advantage is great for those who can control the limited land and specialized management available for production. This type of market structure encourages integration by cigar companies to assure adequate supplies. It may also be a means of preventing control that others might obtain over a stage that is crucial to the end product. Perhaps the relatively few producers of shade-grown wrapper tobacco constitute an oligopolistic industry. Because of few barriers to entry, gaining monopoly control in most other farm products is virtually impossible.

Throughout this report, we have stressed the importance of changes in production technology as reasons for the shifting of stages or processes between firms. In tobacco production one might speculate as to the effect homogenizing tobacco leaf might have on the form of coordination and source of financing. This process, which results in sheets of tobacco, much like sheets of paper, has permitted a new kind of cigar binder. It has had a strong impact upon production of binder tobacco.

Some cigar companies are experimenting with this process as a way of making wrapper tobacco. If quality wrappers could be successfully manufactured from a mixture of nonshade tobacco, there would be little need for the large investment in production that companies now make. They might well be able to buy tobacco of the quantity and quality needed.

Industry Financing of Poultry.—

In view of the outstanding developments in the poultry industry it is interesting to examine the sources

of its financing. Not only has total production increased but average size and investment of firms have expanded greatly in each of the coordinated components—breeder, hatcheryman, grower, feed dealer, and processor. Capital investment has been made under conditions of intense competition and generally declining prices for the purpose of shifting to mechanized bulk operations and otherwise reducing costs.

Credit from the banking system has been important in many instances. Also, the leasing of capital has become significant. Equipment manufacturers may sell their products on a lease-purchase arrangement. Even hatcheries, feed mills, and processing plants may be leased from investors who are prepared to construct them according to specifications. Another method of financing that is just beginning in the industry is factoring. Factoring was used largely in the textile industry and provides financing on the security of accounts receivable. But financing within the poultry industry from its stronger segments has perhaps been most important. Were it not for the firms that are interested in continued production, investment might well have been less. One executive in the feed industry indicated that the financing can come from any one segment to any other, depending upon areas of strength and weakness (47). Frequently, however, the feed manufacturer is the stronger financial link and provides capital to the local feed company so as to keep farm production of broilers and eggs at high levels.

The feed manufacturer may supply capital in several ways. The more usual, of course, is to deliver feed on credit. Also, he sometimes makes cash loans, especially when bank loans are not available. He may lend for equipment and plant improvements or solely to help the local dealer finance operating expenses.

Under some circumstances the feed manufacturer buys stock in the local company to assist in its financing. This differs from the usual stock arrangement in that it envisions a gradual payback to the investor.

One effect of intra-industry financing has been to lead to closer coordination among the production stages. In some instances in which one segment, as a creditor or investor, has had to move to protect its financial interest in another segment this has led to complete integration. Integration with processors and hatcherymen as well as with feed dealers and farmers may be involved.

Coordination and Financing

Early in the chapter the kind of vertical integration that exists on farms was discussed. It was pointed out that the trend had been more one of vertical disintegration, with specialization and purchase of input stages from other firms, both farm and nonfarm. The capital and financing problems then are mainly those of expanding operations horizontally. Although these are very real problems, they are not the problems of vertical coordination with which we are here concerned.

With respect to direct farm-industry coordination, if processors and dealers can more profitably buy from, or sell to, agriculture without investing resources in farm production, they will refrain from such investment. Usually, industry has more profitable opportunities for investment elsewhere. We have seen that for many farm commodities the conventional sources of

financing and the market price system are sufficient to bring forth adequate production. For other commodities, a production contract without contractor financing will provide products of the proper specifications. When contractors do supply resources, the amounts supplied vary considerably depending upon how far they need to go to obtain most profitable results. For certain commodities and for particular situations, financing under contract becomes especially significant.

Only in few instances does it seem advantageous for processors and other businesses to finance farm production entirely within their firms. Important here are specialized farm products for which the market structure involves a high degree of producer or buyer concentration with relatively high barriers to entry. Vertical integration then offers a way of gaining or maintaining a strong market position.

Control of production decisions by the coordinating firm can be stricter under integrated operation and may sometimes justify the additional expense in switching from contractual arrangements. However, in some instances capital and operating costs may be about the same regardless of the form of coordination. For instance, in broiler production, if existing broiler houses can be leased, the costs of rent and labor under integrated arrangements may compare favorably with payments under contractual arrangements.

Vertically integrated production of broilers, eggs, and turkeys is being tried in many localities, and there are some indications of an increased proportion of vertical integration as compared with contracting.

CHAPTER 7.—EXTENT AND TRENDS OF VERTICAL COORDINATION IN FARMING

The preceding chapters have cited many examples of coordinated arrangements in agriculture. The purpose of this chapter is to review in more orderly fashion the general extent of various systems of vertical coordination between farmers and businessmen. We may then perceive more clearly some of the characteristics that bring about differences in coordination in agriculture and business and influence the kinds of coordination adopted for different farm commodities.

Our discussion in this chapter centers mainly on contracting and vertical integration. But there are numerous other techniques of vertical coordination that are used separately or in various combinations with contracting and vertical integration. The market-price system and the related institutional framework are always in the background. Credit and financing arrangements of various kinds that fall just short of contracting often are equally effective.

Because the approach is mainly in terms of the vertical coordination of the production of farm commodities, the discussion does not examine closely the significant field of integration and contracting for the production of inputs for ancillary services and supplies.

Information about the extent of farm production under integrated or contractual arrangements with non-farm businesses is incomplete. The data presented in this chapter are only approximations. The estimated percentages produced under these means of coordination range

from practically zero for some commodities to nearly 100 for others (fig. 12). Among the crops with the highest percentages are vegetable seeds, hybrid seed corn, and sugar crops; among livestock products the highest are fluid milk and broilers. But such comparisons have little meaning unless the surrounding circumstances are appreciated. The following discussion attempts to throw some light on the background of different developments.

Crops

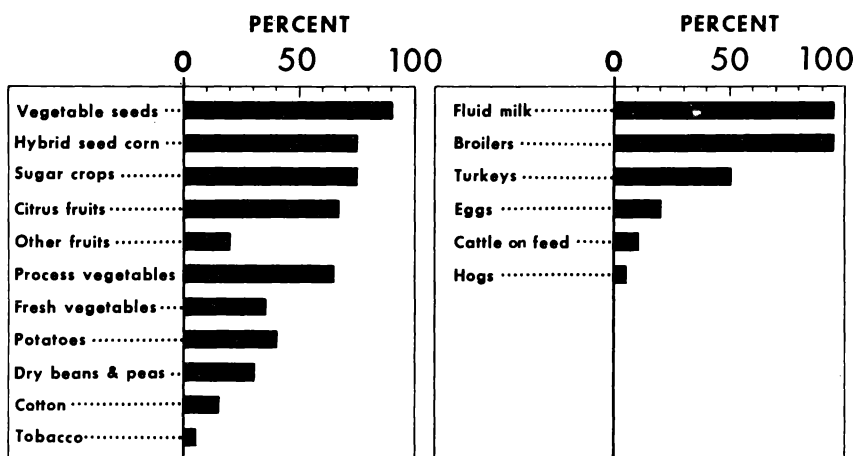
A first division indicated for describing the extent of coordination is that between crops and livestock. Crops are more numerous than livestock and include a greater variety of special situations. On the whole, crops are less perishable than livestock products, but there are many exceptions.

Vegetables

Contract farming has long been significant in vegetable production. About two-thirds of the vegetables produced for canning and freezing are grown by or under contract with processors. Nearly all lima beans, green peas, sweet corn, and cucumbers that are grown for processing are grown under contract.

Contract terms vary widely from simple understandings as to quantity and price to detailed specifications as to varieties, planting dates, cultural practices, and schedules of prices by sizes, grades, and other factors. Seeds, plants, and other

PERCENTAGE OF OUTPUT UNDER INTEGRATED AND CONTRACTUAL ARRANGEMENTS



PERCENTAGES ARE APPROXIMATE ESTIMATES.

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FIGURE 12.—Approximate percentages of the output of selected commodities produced under integrated or contractual arrangements with nonfarm businesses.

supplies and services may be provided by the processor.

Most processing crops, especially if the fresh market for such crops is limited, need close coordination through integration or contracts if waste of resources is to be avoided. If there are special quality factors to consider, there are further reasons for close technical coordination. In processing peas, for example, exact timing of harvest and rapid movement during harvesting are essential if quality is to be obtained. Careful degree-day scheduling of sequential plantings is necessary if harvesting is to be scheduled to obtain a continuous flow of high-quality peas over as many days as possible. This is a higher order of technical necessity than obtains for certain stages in steel production in which cooling down between stages would lead to great expense in reheating. The peas are not amenable to cooling and reheating.

Vegetables grown for fresh market have less formal coordination. But probably half of the fresh vegetable production is assisted by some form of contract or coordinated arrangement for certain stages. For example, the grower-shipper combines the functions of growing, packing, and shipping-point selling.

Potatoes are not usually considered a closely coordinated crop. Yet grower-shipper arrangements probably influence 35 to 40 percent of potato production. Dealers, fertilizer companies, and other financing concerns influence potato production in many areas in ways that approach formal coordination, especially with respect to varieties and marketing practices. Some potato acreage is contracted for such special processing purposes as potato chips. Contracts specify varieties and practices in considerable detail. The potato futures market is still another coordinating

device that is used by some growers and financial interests to assist in financing the crop (64).

Fruits and Nuts

Contract farming and other special kinds of vertical coordination have grown up in the production of many fruits and nuts. Contributing factors have been perishability, specialized production, and concentration in geographic areas with favorable soil and climate. Frequently, marketing arrangements were developed first; later, they reached back into arrangements affecting production. Cooperatives and government programs are often involved.

Much of the citrus crop is produced by growers who are members of marketing cooperatives, especially in the California-Arizona area. Some citrus is produced under a contract for complete grove care including fertilization, irrigation, spraying, cultivation, and harvesting. In Florida, cooperatives handle nearly half of the fresh and a much smaller share of the processed crop. The grove-care type of contract is more common there than in the West.

Deciduous fruits are less closely coordinated than citrus. Cooperatives probably handle about 20 percent of the total volume of deciduous fruits and nuts. A number have field services to advise growers on production practices, as do some private concerns.

The Hawaiian pineapple-processing industry grows substantially all its pineapples. It is an interesting example of vertical integration. The processing companies own and lease land and hire unionized labor.

Processors control large blocks of California peaches and pears and Appalachian apples.

Tree nuts include examples of integrated operations beyond the farm. Almonds and walnuts have more highly developed marketing

specialization than filberts and pecans.

Marketing agreements and orders seem to have had only minor effects on farm-production decisions of growers of fruits and vegetables in most instances. The California State order for canning and freezing Clingstone peaches is an exception that includes definite limitations on production decisions by the producer.

Sugar Crops

The Federal Sugar Act regulates contracting and production of both sugar beets and sugarcane in several ways and provides certain payments for those who have complied with applicable restrictions and observed the law with respect to child labor, wages, and other factors.

Contract production of sugar beets grew up with the sugar beet industry. Neither farmers nor processors could operate profitably without the assurance provided by the contract. Processor-grower contracts evolved from very simple arrangements with fixed payments per ton of beets delivered. Today, they are complex agreements which provide greater incentive for producing high-quality beets and relate the grower's beet price to the price received by processors for sugar. The beet processors provide seed and furnish fieldmen who influence production management. The processors also assist in obtaining seasonal labor (40).

Sugarcane is grown in Hawaii, Florida, Louisiana, and Puerto Rico, and the conditions of production differ among areas. Elements of vertical integration are found in each. The Hawaiian industry is most completely integrated; it presents an intricate combination of plantation farming and milling with cooperative refining and marketing of sugar. In recent years, a large part of the Florida cane has been produced by one grower-processor. In Louisiana and Puerto Rico, more

than half the cane is grown by independent growers.

Dry Beans and Peas

Electronic sorting equipment and the high investment necessary in it are said to have contributed to vertical integration in the marketing stages of dry beans and peas. It may have helped strengthen contractual relationships with farmers to assure an adequate volume of supplies. Cooperatives handle 20 to 25 percent of the dry beans produced and perhaps 35 to 40 percent of the dry peas. Most of the cooperatives contract with growers and some independent dealers also use contracts. Most of the contracts contain quality standards. Many specify time of delivery and accord field-inspection rights. Apparently, few contracts with cooperatives specify price or provide financing. Contracts with independent elevators often go farther in providing supplies or financing.

Contracts for dry beans and peas are rather mild arrangements that give the farmer some assurance of a market outlet and may stimulate improved practices. Apparently many growers in the same areas operate without them.

Cotton

Contract farming is a minor practice in the cotton industry so far as the management decisions of cotton producers are concerned. But market decisions for a substantial number of cotton producers are affected by credit extensions from processing and marketing firms. The need for credit began with the first commercial cotton production in the United States (23). But the extension of such credit by gins and processors seems to be related mainly to their need to assure a sufficient volume of business for their facilities.

In California and the Southwest, gins or oil mills supply credit for

production expenses on more than half the total cotton production. In the Mississippi Delta, some of the large-scale growers have financial interests in gins and oil mills, but the proportion of the total production that is so related with non-farm firms is less than half that in the West.

Local gin managers who supervise credit extension are often available for many advisory services not set forth in the loan agreement. Some of these services may be related to cotton production.

About 15 percent of the total U.S. cotton production is handled through cooperative gins, oil mills, and marketing associations. In some areas, the amount handled is 25 percent or more.

The structural organization of the cotton industry thus differs from those of dry beans and dry peas, for example. But detailed study of each would be required to determine in which industry nonfarm firms exercise the greatest influence on farm production decisions.

Special Crops

Contract farming and sometimes direct processor production is found in the production of a number of special crops. Most of these crops have limited or specialized outlets and involve unusual risks or high investment. A few examples are mentioned below.

Shade-grown and aromatic tobaccos are special types which together make up about 4 percent of the total value of the tobacco crop. Aromatic, or oriental, tobacco is contract grown on a few hundred acres in the Carolinas. Probably no one would risk growing it without a market contract.

Shade tobacco involves a heavy investment in cloth, poles, and wire plus high outlays for labor and fertilizer. Tobacco manufacturers themselves produce more than half

of the crop and contract producers the rest. High expense and high risk have made it a corporation or contract crop from the beginning.

Mustard seed contracting companies in Montana and California make commitments with business firms in large metropolitan centers that use mustard seed for spice, oil, and drugs. They then contract with farmers to grow it, specifying quantity and price. In some years, nearly all the acreage is contracted, in other years, much less, depending on the outlook for supplies.

Most popcorn is grown under a contract which specifies variety and a minimum price for the output of contracted acres. Seed and sometimes cultural advice are furnished.

About 90 percent of the acreages of castor beans and safflower are grown under contract. The contractor typically furnishes seed, provides technical assistance, and specifies the harvesting date and the price per ton.

Crops Grown for Seed

Most seed crops represent unique situations requiring close control (43). This is especially true for vegetable and flower seeds and hybrid seed corn. Field seeds are grown under looser controls, but even for them cooperative seed-improvement associations provide some supervision.

Vegetable seeds are raised by seed companies themselves or under closely supervised contracts. The companies are responsible under State and Federal regulations for accurate labeling. Foundation stock is usually grown on farms operated by the seed companies, and further expansion is obtained by placing contracts with farmer growers. But the seed company may perform many of the production and harvesting operations with its own labor and supervision.

The contract spells out the exact responsibilities of each party in detail.

Hybrid seed corn is grown in a similar way. First, the foundation work is done on company-operated land, then selected growers contract to produce commercial seed stock. The grower does little more than planting and cultivating. The seed company does all the rest.

Only small percentages of grass and legume seeds are grown under contract, but the proportions are increasing as production becomes more concentrated in favorable areas.

Livestock and Poultry

Poultry and Eggs

In recent years contract production has developed more rapidly in poultry than elsewhere in agriculture. The reasons are closely connected with the great changes in technology that have taken place in poultry and in the formula feed industry.

In the main, the commercial broiler represents a new product produced in new areas. The problem of overcoming traditional ways of farming was not present in any great degree. About 95 percent of broiler production is on some kind of integrated or contract basis. In most areas, feed dealers have been the focal factor in broiler expansion. From simple credit financing and open-market production, the industry has shifted through a variety of contractual arrangements to some form of minimum guarantee plan for the grower, adjusted for feed conversion and other factors. In many instances, feed, hatching, and processing facilities have been merged or tied closely together, and a part of the industry is almost on an integrated meat-manufacturing basis. But grower contracting is

likely to be with the industry for some time.³³

Turkey production tends to follow the pattern of the broiler industry, but with more of the arrangements in terms of conventional lending rather than under contract.

In production of market eggs perhaps 5 percent of the production in recent years was under the type of contract production in which the pullets and feed are furnished producers by the program operator (5). Producers furnish housing facilities and labor. The eggs belong to the program operator, and producers are paid on the basis of the number of eggs produced with bonuses for efficient performance.

Probably another 5 percent of the total egg production was accounted for by "contract marketing and quality-control programs" in which eggs were produced and marketed under specified conditions to meet high-quality standards. Increases in these kinds of programs together with vertical integration probably would bring the total of these types of vertical coordination up to 20 percent.

Dairy Products

Many observers might say that there is little vertical coordination in the dairy industry. Producer-distributors, for example, produce less than 2 percent of the total milk supply, and apparently there is little contract production of the kind we know in broiler production.

A few dairy cow pools have been formed in recent years but they are concerned more with horizontal expansion in scale and have a minimum amount of vertical coordination.

Another type of vertical arrangement to lease milk cows to dairymen

who wish to expand but lack capital was formed by a new agricultural corporation in Wisconsin in 1961. Some 200 cows were placed in the first few months of operation. Dairymen sign a 1-year lease for each cow at a rental price adjusted to the cow's age and productivity. The corporation has the leased cows T.B.-tested and vaccinated against brucellosis and checks on their general health and welfare. Most of the cows are leased to build up a larger base of operations for a going concern.

Recent trends in the dairy industry have been more in terms of a greater degree of coordination in establishments beyond the farm, although mergers may be proceeding more slowly since they have met with some adverse court decisions.

But the dairy industry really presents a well-matured pattern of vertical coordination that has grown out of the developments of several decades. Milk-marketing contracts are more concerned with marketing than with farm production, but they form part of a total complex of relationships affecting production that includes community health regulations, Federal and State milk orders, seasonal pricing, and in some instances, quotas. Producers are effectively bound to a set of practices that are certain to affect their production decisions in many ways. When individual producer bases are a part of the marketing contract, farmer decision-making is still more circumscribed.

Beef Cattle

Changes in vertical coordination in beef cattle are focused around the growth of the large commercial feedlot. Many other changes in production and market structure are interrelated, but apparently these feedlots in the West provide a way in which feed and management resources can be mobilized to do an efficient job of finishing cattle for market and perhaps in providing a market mechanism as well.

³³ See historical discussion of the development of the broiler industry in Delmarva in the report by George Soule, Martha V. Taber, and Mary M. Kirkwood (55).

Custom feeding of cattle may represent a type of coordination forward by farmers and ranchers, coordination backward by packers and chain stores, or a specialized independent operation.

Contract sale of feeder cattle and calves for future delivery has been a practice for many years. In recent years, such contract sales of feeder calves have apparently increased, but this may be related to the drift in the cattle cycle.

Sheep and Lambs

Contract feeding of lambs in commercial feedlots on a weight gain or a daily charge basis takes place on much the same basis as for cattle. Contract buying of feeder lambs for later delivery is also practiced.

Hogs

Contract production of hogs has been tried on a minor basis in recent years, but apparently with indifferent success. Feeder-pig contracts set up somewhat like broiler contracts have appeared in areas on the fringes of the Corn Belt and in the South. The contractor, usually a feed dealer, supplies the feed, pigs, and general management, and markets the hogs. The grower is paid a fee per pound of gain. A supply of good feeder pigs is a limiting factor in this type of contract.

Another type of contract, known as the sow-and-pig contract, consists in leasing bred sows to farmers to help them get started with better quality strains of meat-type hogs.

Several problems of technology probably need to be solved before any marked changes in present hog-producing methods take place. If artificial insemination methods are improved and diseases controlled so that pig "hatcheries" turn out considerable numbers of uniform-age, disease-free pigs, vertical coordina-

tion in hog production might be affected considerably.

Trends

In considering trends in vertical coordination each commodity or group of commodities might be examined in detail for changes taking place. Some indications of this kind are given in the preceding discussion. As a very broad generalization, coordination arrangements in crops are older and more stabilized than those in livestock products.

But let us look at certain more general aspects of trends in coordination. Consider first the increasing specialization in farming that is associated with technology. Recently published data on the composition of major inputs in agriculture are helpful on this score (41). Substitution of capital and intermediate inputs for labor and land has been very marked since 1940. From 1940 to 1960, the percentage of total inputs in farming coming from nonfarm intermediate products rose from 30 to 59 percent, or nearly doubled. Although not entirely associated with a lessening of vertical integration on the farm, it is a partial indication. Power and machinery inputs on farms more than doubled and the nonfarm inputs related to feed, seed, and livestock increased similarly.

The increasing commercialization of agriculture means that fewer of the traditional farm stages are found on farms now. In this sense farms are less vertically integrated than formerly (57 and 38, p. 13). More intermediate goods are produced elsewhere, even though this sometimes means the introduction of new farm stages also. In addition, many stages in product refinement have been transferred from the farm to processing plants off the farm. Creameries, milk plants, egg receiving plants, grain banks, and

the like represent a shift of stages away from the farm.

From this general background of change and specialization arises the need for changes in coordination. This is a continuing process in both the nonfarm and the farm sectors of industry. In urban industry, it has often led to a regeneration of vertical and horizontal integration. In agriculture, it leads to similar realignments and especially to the development of contractual arrangements and other less formal understandings of various kinds that tie together the whole fabric of production activity.

As indicated earlier, special coordination arrangements for crops are older and more stabilized than those for livestock products. Time has permitted the process of trial and error to develop many variations so that when some new need arises, it is less difficult to draw up a satisfactory arrangement. In most instances, the trends in vertical coordination arrangements for crops represent minor refinements and changes from previous plans. Processing crops especially have a long record of adjustment to fit particular conditions. Further changes may be anticipated for the closer coordination of fresh fruits and vegetables to meet the increasing concentration of purchases from large scale buyers and their specification needs.

The introduction of innovations requiring large capital investments either on the farm or in processing stages may tend to strengthen any existing contractual arrangements.

Many changes in commodity contracts tend to be episodic, temporary, or cyclical in nature and may recur if similar conditions appear again. Thus supply shortages may make a processor more interested in contracting in succeeding seasons.

Livestock and Poultry.—Integration and contracting trends in livestock and poultry usually stir the most interest and discussion. The

development of the commercial broiler industry is largely responsible for this interest. The poultry industry has felt the impact of new technology more than other livestock and has shown a phenomenal response.

Nearly continuous change in structural arrangements for producing and marketing has characterized the broiler industry from its inception. These changes are by no means over. The particular directions they will take in the future are difficult to project because conflicting forces may operate. In the absence of national programs it is possible that the industry will become increasingly integrated into a relatively small number of large-scale poultry meat-manufacturing firms. These firms would combine feed manufacturing, broiler production, and broiler processing stages.

Various forces may check such a development, however. The development of a Federal supply-management program is one of a number of possibilities that might change the basis of competition and preserve larger numbers of competitive producing units less integrated with agribusiness. The general organization of producers into bargaining cooperatives is another possible change that would affect the structure of the industry.

Developments in egg production are more varied and are likely to continue so. Concentration into larger producing units seems likely to continue. Although some increase in vertical integration and contract production is probable, this may be a much less dominant development than in poultry-meat production.

The dairy industry is already highly coordinated and aside from a continual movement toward larger-scale operations, the structure of the industry is less subject to rapid changes.

It is in hogs and beef cattle, where technology has apparently lagged, that the most startling changes might

occur. There is considerable basis in research findings of recent years for expecting a very large increase in the feed and labor efficiency of producing livestock products in the next decade or two. This is especially true for hogs. Because some of the new technology will require both capital and supervision to put into effect, there is a strong presumption that some new vertical coordination arrangements will be tried in hog production.

Changes in hog production may occur most rapidly outside the established commercial livestock areas, at least in the beginning. This may cause a considerable readjustment of the livestock map. Changes in livestock production in the past were closely confined to the farm and related to natural geographic advantages. But in the period ahead,

capital, labor, and special management may be provided to a great extent from other sources. These sources will be the various agribusiness firms providing supplies and services and processing and marketing farm products. As stated by one observer:

"Livestock production will increase most in those areas where feed companies, financing agencies, and other agribusiness firms offer technical assistance and provide imaginative leadership in meeting the new opportunities provided by technological developments in a dynamic, vibrant, and vigorous industry. Any firm, either farm or farm-related, that prefers not to meet this challenge will be bypassed or supplanted by those firms that have the imagination to do the job that is needed" (65).

CHAPTER 8.—IMPLICATIONS OF VERTICAL COORDINATION IN AGRICULTURE

We are interested in the broad implications of vertical coordination in agriculture. It is not so much vertical coordination in general that concerns us, because all production is vertically coordinated in some way, but rather the action of specific forms of vertical coordination. Further, effects of such action are often measured against a background of change from more traditional forms of coordination.

New studies of actual situations are needed before we can be sure of many of the consequences of particular systems of coordination. But some things we do know from evidence of experience. The significance of vertical structuring in farming and between farming and industry has become more apparent with the increasing interdependence of agriculture and other industries. Farmers are becoming more like other businessmen in their dependence upon purchased supplies and services. Expenditures for machinery, fertilizer, formula feeds, pesticides, and other inputs from nonfarm sources are increasingly important. Farmers find themselves more dependent also upon special marketing and processing outlets than formerly.

The complexity of the changes in vertical coordination in agriculture is suggested by the trend of the discussion in the preceding chapters. In a very real sense, the changing form of coordination is the structural counterpart of the specialization and division of labor that characterize a dynamic industrial economy. Both processes parallel

and interact on one another. In some instances, technological change may be followed by structural change; in others, structural change may stimulate the more effective application of new technology.

Improved methods of coordination, like new inventions of any kind, affect the economy as they are adopted. The specific effects of particular kinds of vertical coordination can be determined only by the study of particular situations. However, certain broad observations can be made.

Motivational Influences

Maximizing Returns

One of the first steps in this analysis was in terms of the economic theory appropriate to maximizing monetary returns to the individual firm under competition. This was followed by a consideration of elements of market structure and advantage, risk and uncertainty, financing, and other factors that are motivational influences affecting the kinds of vertical coordination.

The general effects of changes in vertical coordination are related to these same elements. The extent and the proportional combinations of different effects may vary greatly according to circumstances. In situations that remain essentially competitive, a principal effect of vertical integration, contracting, or any improvement in coordination is one of expanding output, and lowering costs and prices. This comes about through better management, greater

adoption of new technology, better scheduling to avoid waste effort, and similar factors. The same basic resources become more productive.

These circumstances appear to have been important in the expansion of commercial broiler production. But broilers represent an unusually rapid development for several reasons. A very favorable combination of circumstances characterized the setting—a virtually new commodity with potentially elastic demand, a newly developed set of techniques for production, and few traditional obstacles to overcome. High risk and capital shortages were offset in considerable measure through the economic interest of the feed industry and other nontraditional sources of financing.

More slowly operating forces have determined the evolution of the fluid milk industry and the shift from earlier forms of coordination has been more gradual. Nevertheless, the patterns of vertical coordination in fluid milk are probably even more elaborate than those in the broiler industry.

Profit maximization, based on coordinating or combining adjacent vertical stages to obtain the greatest economic efficiency, is a primary motivation in most vertical coordination that affects agriculture.

Market Structure and Advantage

Vertical coordination in farming may have received somewhat less consideration from the viewpoint of market advantage than vertical coordination in industry, because of the generally small-scale firms that characterize farm production. But in certain situations in the purchasing of services and supplies and in the marketing of farm products, the number of business firms facing farmers is small enough to raise important vertical structural questions. The difference in viewpoint between a farmers' cooperative and a private corporate firm in certain

situations illustrates one set of problems of this kind. As Clodius and Mueller have suggested, market conduct may differ radically when one firm is completely integrated, and other firms in the industry are compelled to buy one stage from this firm (17).

So far, considerations of market advantage seem to have played a small role in broiler expansion. They may be of greater significance in the future if the number of integrated concerns controlling the business becomes small. Growers may find it desirable to organize cooperative bargaining associations to protect their position. Contractors may prefer to deal with cooperatives rather than with labor unions.

The experiences of producers of milk and other farm products with cooperative bargaining associations contain many instructive lessons concerning what can and what cannot be achieved in this direction.

Financing Farm Resources

As noted, one of the important effects of certain forms of vertical coordination in some situations is to provide either credit or capital equipment and supplies needed to facilitate desired adjustments. The relationship in the broiler business is well known. But there are many other illustrations.

In the fluid milk industry in recent years, for example, the introduction of bulk milk tanks on the farm has been greatly facilitated through credit furnished by cooperatives and milk-receiving companies. Payments are often made by milk check deductions over a period of time.

In many processing-crop contracts, provision is made for the company to furnish special machinery or services, especially for harvesting operations. This reduces capital costs for the grower and provides more effective and uniform performance all around.

It may be suggested that the greater availability of credit under vertical coordination arrangements may tend to overexpand output. But in most instances, the processor who extends the credit has a direct interest in the outcome, maintains some supervisory and management control, and is selective in his choice of producers. Elements of supply management are often part of his total plan of operations.

The implications of increased financing through integration or contracting devices may be far reaching. An increase in contracting, for example, means that more capital for use on farms will be furnished indirectly from outside agriculture and so far as it ultimately comes from the banking system, more of it will be supplied by the urban banks that largely finance the business concerns serving agriculture. Tracing these ramifications will not be a simple task, and the ultimate sources may be difficult to determine exactly.

Risk and Uncertainty

The effects of various kinds of vertical coordination arrangements on risk and uncertainty are many. Some arrangements widen the area over which uncertainties are spread in terms of both scale of operation and time. Certain types of contracts result in pooling arrangements that share markets and prices on a more equitable basis than would occur in continuous open market arrangements. Uncertainties of market outlets and prices are reduced.

Other hazards may be reduced also. For example, access to better technical information and advice may raise yields. Processing companies frequently assist growers in obtaining adequate harvest labor. Reliable sources of seeds and other supplies of high quality may be more accessible. Some advantages in prices of input items also may be available.

The implications of using vertical coordination to control risk and uncertainty lead to questions about insurance, futures market operations, and other devices used for the same objective. The extent to which these alternatives may conflict or supplement one another may have significance. For example, a futures market operation may be an important element of a Maine potato grower-dealer contract.

Barriers to Change and Basic Beliefs and Values

We have said little about barriers to change in vertical coordination except for occasional references to institutional problems. Yet these may represent formidable obstacles. Earl Butz, for example, believes that "political leaders will resist vertical integration in agriculture, in their oratory, in their congressional hearings, and in their legislation. The philosophy of the small, owner-operated, family farm is deeply ingrained in our sociological and political mores . . . Political pressure will continue to be on the side of maintaining small family farms, even though modern technology dictates strongly that family farms become larger" (13).

Farming in this country early developed a set of basic beliefs and values around the concepts of private enterprise and the family farm. What Brewster has termed "the private enterprise creed" holds that the farmer has the unfettered right to run his farm business as he pleases. This means no restrictions on his freedom to make all management decisions (12). Customary modes of operation are often difficult to change unless the advantage of the change is direct and obvious. Even then, force of habit and tradition may be difficult to overcome. Communities and types of farming in which certain methods have been customary do not respond immediately to proposals to shift to contract

arrangements unless economic conditions are severe and the incentives are great.

On the other hand farmers in a community in which contract farming has been practiced for a long time would be equally loath to shift to another arrangement for vertical coordination. They have developed a different set of beliefs and values, or else they have incorporated the different system of coordination into the accepted customs so that they fit into the same set of values.

It is certain then that the continued use of a new kind of vertical coordination in a community eventually affects the community's value judgments about it. It becomes traditional.

As with innovations of any kind, changes in vertical coordination may have transitional effects that create difficult problems. Those farmers who for one reason or another are not able to participate in a new structural alignment will find themselves at a disadvantage, they may be forced to give up the production of a particular commodity or even to retire from farming. But the existence of several kinds of vertical coordination may greatly ease such transitions. In some instances, contract farming may be a transitional phase leading toward more complete vertical integration later. Or contracting may be a way of introducing a new farm commodity which eventually will be produced independently for an open market. In either case, it becomes possible to work out the ultimate adjustment more slowly and with less frictional cost.

Should subsequent events prove that commercial broiler production, for example, can be handled more efficiently as a factory operation on a very large scale, completely integrated in both directions, the elimination of farm producer units would raise a number of social questions. This would be especially true if the change occurred within a

relatively short span of time. In the meantime, contracting would serve as an effective transitional cushion.

Bargaining cooperatives may have an important cushioning role also. Contracting farmers are usually small and at a disadvantage in contracting with a large dealer or processor. Competition between contractors may protect the growers for a time but eventually this protection will not be sufficient. Then serious attention needs to be given to group bargaining. Cooperative bargaining associations are designed to help farmers provide countervailing power for themselves.

Supply Management and Other Implications

The use of contracting or integration as devices for supply management has been advanced on a number of occasions, notably by John H. Davis (20). This has involved a rather elastic definition of vertical integration, however. It would seem more desirable to regard vertical coordination devices as facilitating parts of the total structural arrangements that make supply management possible. They may perform a very useful role in some combinations. For example, consider sugar beet contracting which represents a long-established practice. Here acreage contracts were used from the beginning as a basis for adjusting output to the capacity of the processing plant. In conjunction with later Federal programs, this device has been used to adjust sugar beet production up or down. Here it is possible to say that, along with other devices, vertical contracting has been helpful in a supply management context.

Elements of supply management are present in many of the producer-processor contracts for perishable

fruits and vegetables in which plant capacity is limited and supplies may be seasonal.

We return then to the key concept that changes in vertical coordination are a companion counterpart of changes in specialization and that the interplay between them is a continuous feature of a dynamic economy. Specialization and coordination are not all that are changing and influencing the outcome of economic events. In turning our analytical focus on vertical coordination, we need to remember many other features of the economic landscape through which we travel.

One of the areas of vertical coordination that deserves more attention is that associated with service contracts. This is sometimes called disintegration, but it is really a form of specialization and coordination through contracts. Many tasks once done on the farm are now

accomplished on a mass production basis by nonfarm businesses. Many new services not available earlier are also handled in this way. Not only are such services supplied at lower cost but with more technical knowledge, they are done more efficiently and productivity is enhanced. They also permit the farm operator to expand his own operations in the areas in which his advantage is greater.

Particular coordination devices are simply tools for getting things done. The greater the number and variety of coordinating tools available, the greater is the likelihood of getting results efficiently accomplished. The choice of the right tools will serve to strengthen the position of the family farmer by enabling him to gain many of the advantages of corporate management while remaining relatively independent.

CHAPTER 9.—RESEARCH NEEDS IN VERTICAL COORDINATION

The purpose of this chapter is to discuss certain areas that need exploration and to suggest some lines of effort that might be developed as specific research projects.

The area of vertical coordination that concerns us here is the part that has to do with the production taking place on, or in close proximity to, the farm. We are not immediately concerned with the manufacturing, processing, and marketing that take place more remotely except as they bear upon the farming operation. But we should not restrict the scope of inquiry if it leads some distance away.

Few things are entirely new, and much that is pertinent to research in vertical coordination will be found in research programs already underway. Although there has sometimes been a tendency merely to put on new labels and go ahead doing the same kinds of things, there is more to it than this. The significance of examining old problems from new points and of focusing on the structural aspects of production is greater than just a change in names.

The general viewpoint held by the writers about contract production (or any form of vertical coordination) is that it is a method of carrying on production, a kind of institutional machinery for getting things done. One cannot say that a machine is intrinsically good or bad, nor can one say that in itself contracting is good or bad. A well-made machine may yield good or ill results according to how

and where it is used. And so it is with contract farming and vertical integration.

This and related considerations suggest grouping research studies of vertical coordination into five categories:

- (1) Studies of Measurement and Description;
- (2) Studies of Performance and Effects of Various Kinds of Vertical Coordination;
- (3) Studies of Social Attitudes and Educational Methods;
- (4) Studies of Methods of Improving Vertical Coordination;
- (5) Studies of Supply Management.

Studies of Measurement and Description

In opening any new area of research, descriptive studies are likely to be undertaken while researchers are becoming familiar with the field. A number of such studies have been made to describe the various kinds of contracting and other arrangements that obtain in the production and marketing of broilers, eggs, sugar beets, and processing vegetables. The great need now is for analysis that goes beyond description. One type of study that involves more exact measurement is suggested in the following proposal for measuring capital inputs in agriculture that are financed by nonfarm businesses. These are the advances of supplies and services that are not adequately reported in agricultural statistics. They are

owned by the nonfarm businesses and are therefore not reported as extensions of agricultural credit.

Project 1.—Measurement of Capital Inputs in Agriculture Financed by Nonfarm Businesses

Objective: To develop a basis for estimating the amount of investment financing in agriculture accounted for by advances of input factors by nonfarm firms engaged in vertical integration and contract production in farming.

Discussion: Existing series are limited to data on the farmer's own equity financing and conventional credit financing by institutional and private lenders. An important and growing source of financing, especially of current expense items, is through contract farming and vertical integration devices of various kinds. Most of this is not a type of credit but a form of equity financing on the part of nonfarm firms, which have extended their operations into agriculture. Some of the investment represented by this extension may be inaccurately reported as credit financing, but much of it escapes the present statistical series.

Another different but related type of investment in agriculture by nonfarm firms is that involved in a variety of contract custom service operations. A considerable number of custom operations are by nonfarmers, and the investment in machinery and equipment used on farms in these operations is not at present included in farm investment. This is true also for rental equipment owned by nonfarm firms. Here is another gap in farm investment data; it is not large but is likely to grow larger.

Procedure: Some preliminary exploration of possible approaches to the construction of a series of estimates that could be maintained would be desirable as a first step. The alternatives might include:

(1) An area type-of-farm approach modal composite would be constructed similar to that used in building the U.S. Department of Agriculture series on cost and returns for commercial farms. The problem of aggregation to regional and national levels would present some difficulties, but perhaps no greater than for other approaches.

(2) A straight area approach for selected areas cutting across all types in the areas and then aggregating these to regional and national totals. The difficulty of aggregation would depend upon how many areas could be sampled and how well these areas were selected. The kind of investment represented is not randomly distributed, so probably as much judgment would be needed in this approach as in the other one.

Project 2.—Case Histories of the Growth and Development of Vertical Coordination

Objective: To study origins and causes of changes of vertical coordination by analysis of selected case histories for important commodities and areas.

Discussion: Vertical coordination is a phenomenon of growth and development, and the causes and even the succession of parts of such dynamic changes are likely to be veiled in the mists of unrecorded events. Only by careful examination of the serial happenings leading up to the present shape of things can full understanding be achieved. Otherwise, separate and scattered events are more likely to appear like the successive patterns seen in a frequently shaken kaleidoscope—designs beautiful to behold but with little relation to each other.

Some of the real reasons for vertical coordination differ from the explanations offered at a later date; some are accidental; others are covered up. Tracing the record may clear up some of the mystery.

Procedure: Preliminary analysis is first needed to provide for selec-

tion of commodities and areas to be studied. The general steps would include:

- (1) Selection of commodities and areas,
- (2) Collection of pertinent historical data and information, and
- (3) Analysis of material to build a consistent historical statement.

Sources of data include official statistics of production and marketings. But more important may be personal interviews with some of those who have been pioneers in the development of an industry. Of course, other studies already made may include important parts of what is needed.

Studies of Performance and Effects

The effects of various kinds of vertical coordination on technology, uncertainty, production, and prices may be substantial, and similarly the reciprocal effects of these factors and others on methods of vertical coordination may need to be reckoned with. Studies in this group have wide and basic application and deserve careful attention. The five projects briefly outlined below suggest general ways of approaching the problem that would need to be developed in terms of specific commodities and situations.

Project 3.—Supply Response to Systems of Contract Production and Vertical Integration

Objective: To estimate the probable extent of supply response to specific systems of contract production and vertical integration for specified farm products, for example, commercial broilers.

Discussion: Broiler production has expanded greatly in recent years, and it seems likely that some part of the expansion is a result of contract production. How much is difficult to determine because new technology, new areas of production,

and other factors are intermingled. Evaluation of the relative roles of contracting and other influences would be useful.

Procedure: One method of evaluation is to conduct a careful qualitative and historical analysis of development in each of several significant broiler-producing areas. Such an analysis would attempt to trace what happened in each area and to appraise the relative influence of different causal factors.

A second method would be to make a comparative budget study of typical producers under a general contracting system and under an independent regime. This would attempt to estimate break-even points for prices and outputs, from which aggregate estimates might be constructed. Such a determination would be in terms of highest marginal profit compatible with the differences in uncertainty present. Some equivalence between net monetary return and uncertainty would need to be sought.

Project 4.—The Effect of Systems of Contract Production and Vertical Integration on Uncertainty in Farm Production

Objective: To determine the extent to which economic uncertainty is shifted or reduced by means of contracting or vertical integration for specified commodities and situations.

Discussion: One of the advantages frequently cited for contracting and large-scale vertical integration is the reduction in uncertainty associated with such operations. One element is related to the larger scale of operation, which brings about an averaging over large numbers and over time and space. Another element is the averaging of uncertainties between vertical stages. The transfer of the incidence of risk will also affect the position of particular parties.

Uncertainties relate to such things as market outlets, price variations,

yields, and mortality. In addition to the principle of averaging out fluctuations, improved coordination may lead to closer control of factors influencing uncertainty. In this way, the chance of an adverse outcome is also reduced.

Procedure: The effect of coordination on uncertainty must be studied mainly on a commodity basis because most hazards vary by commodities. One approach is to construct synthetic models to measure the mathematical relationships. The assumptions that enter these models would be based on actual experience.

Probability curves for particular hazards can be constructed to show the difference in uncertainty for small and large scale units, for independent and contract operations under specified conditions, and for each party concerned. Such comparisons can be made with the level of technology held constant or with appropriate differences assumed for the independent and contracting situations. Such comparisons will throw light on the extent to which contracting or integration has reduced the chances of loss from specific uncertainties and on how the impact of uncertainty has shifted.

Project 5.—The Effect of Contracting and Vertical Coordination Devices on Prices of Inputs and Outputs

Objective: To evaluate the effect of contracting and other kinds of vertical coordination on prices of inputs and outputs.

Discussion: It is sometimes said that certain systems of contracting and other arrangements for vertical coordination tend to raise prices of farm inputs and lower prices of farm products. Because such arrangements change methods of price determination and location of markets, there is a strong presumption that various things may happen to the way in which prices are determined. But apparently there is no good reason for thinking that develop-

ments will always be one way or another. Probably the changes will be varied.

Procedure: A first step in approaching this problem would be a qualitative examination of the nature of the marketing arrangements prevailing in a number of commodity situations in which one method or another of coordination prevails. The number of buyers and sellers, the alternatives open to them, the information available in the market and other pertinent factors need to be appraised. Interarea and inter-market comparison of prices may reveal differences that suggest more active competition in some places than in others.

In poultry and livestock contracts that involve advances of feeds, the arrangements for pricing feeds may fail to reflect outside market conditions. Similarly, contracts with processors may be competitively arrived at but may not reflect market prices sufficiently.

For example, 40 percent or more of the broilers produced in some States in the South are transferred from farms to processors through intracompany transfers with no farm price quoted. Under such contracts, growers are likely to be paid some kind of guaranteed piece rate with a feed conversion premium for efficient performance. In this situation, the price of most consequence to the farmer is the price of his labor (plus the rental value of his real estate and equipment).

Project 6.—The Reciprocal Influence of Technology and Forms of Vertical Coordination in Agriculture

Objective: To analyze the effect of new technology on contract farming and vertical integration and the influence of the latter on the development and application of new technology.

Discussion: Examination of the background of instances in which contracting and vertical integration have developed frequently in-

icated a close interrelationship with new technology. This is true for commercial broilers, eggs, certain processing crops, and some specialty crops.

Analysis of such interrelationships might well lead to greater understanding and improved guidance for current and future developments.

For example, a number of new labor-saving machines for harvesting tree fruits and certain vegetables are now in various stages of development and early trial. Some of them have very large capacities and may be owned by a processor. What effect will this have on grower-processor relationships and upon concentration of production and control?

Procedure: Dividing the analysis into two phases seems to be indicated: (1) Historical case analysis to describe carefully what has happened in specific commodity developments; and (2) analysis of currently emerging situations to foresee the relationships that may develop.

The effect of vertical integration and contract farming on the development of technology may also require a still broader approach in which the influence of many factors that jointly influence the course and rate of development of new technology would be appraised.

Project 7.—The Effect of Contract Production on Freedom of Entry and Exit

Objective: To evaluate the effect of contracting (or other kinds of vertical coordination) on freedom of entry (and exit) into the production of a specific commodity.

Discussion: For many perishable farm products that require processing, a contract is a practical necessity in order to obtain access to a market outlet. A fluid milk producer, a broiler producer, or a sugar beet grower must be assured of an outlet before he can safely begin production. The terms on

which contracts are obtained and whether they are available on an open competitive basis are pertinent in appraising whether entry and exit are approximately free.

Ease of entry does not necessarily mean that a plant must take all producers who apply. A particular processor may have two limitations to consider. One is the physical capacity of his plant. The other is that of market demand. For example, a fluid milk distributor may be in a position to choose between taking on additional producers or obtaining the same quantity of milk from the present producers. It may cost him no more to get it from the present producers, who might then enjoy permanently better incomes more in line with long-run competitive levels.

Procedure: Analysis of freedom of entry and exit under contracting would need to be examined for a number of selected areas and types of contracts for the specific commodity. Possibly, a cross sectional study of contracting for several commodities at the same time would be more useful than a study of contracting for only one commodity.

Studies of Social Attitudes and Educational Methods

Attitudes toward innovations may have much to do with rates of adoption. Sometimes adoption comes too rapidly, at other times too slowly. We see this phenomenon at work all around us among consumers and among producers. Some attitudes are deeply fixed and change slowly; others are more superficial and change rapidly.

Knowledge and understanding of what attitudes are is important in working out the ultimately desirable adjustments and the rates at which they can be achieved.

Some believe that contract farming is something that will tend to hasten the end of the family farm,

but others take the view that it may slow down the pace at which family farms are disappearing. At any rate, it is desirable to learn as much as we can about farmers' attitudes concerning these things so that we can approach the problem in a more rational way. One project in this area is suggested below. Several others could be outlined.

Closely related to attitudes are the educational methods used to modify them. Traditional extension methods have been successful in many ways, but recent developments in supervisory techniques used in contract farming and other kinds of vertical coordination seem superior for certain situations.

Project 8.—Social Attitudes Toward Alternative Forms of Vertical Coordination

Objective: To appraise farmer attitudes toward contract farming, vertical integration, and other forms of vertical coordination.

Discussion: Operations under contracting and vertical integration differ in many respects from those on many traditional family farms. These differences have led many to fear a possible loss of independence and freedom with respect to the management and operation of these farms. Whether these fears are well founded is a question, but it may be important to know the extent to which they are held.

Several survey studies in recent years have asked farmers what prices they expected for a particular farm commodity and what contract price they would be willing to accept instead. The answers to these questions have usually indicated an aversion rather than a preference for the certain advance contract price. This is to say, more indicated that they would need to be paid a premium over the expected open-market price before they would be willing to contract. However, most of these studies were conducted among farmers who were not familiar with contrac-

ting. They reflect conditioned attitudes.

Procedure: Studies of farmers' attitudes about several key elements (price, for example) would need to be conducted in pairs, so far as possible. For example, for each analysis conducted with independent farmers, a paired analysis would be undertaken with contracting farmers. If several distinct types of contracting were pertinent, each of them might need to be included. In this way, some measure of influence of participation in a particular kind of coordination might be obtained.

The wording of questions would need to be worked out in cooperation with sociologists and specialists skilled in this type of analysis.

Some separation of preferences or aversions according to depth of feeling or significance might need to be sought. Which attitudes would be real obstacles to essential changes and which would pass away quickly is important to know.

Project 9.—Supervision Under Vertical Coordination as an Educational Technique

Objective: To appraise the relative effectiveness in getting new technology adopted under alternative teaching and supervisory methods for specific farming situations.

Discussion: The Agricultural Extension Service uses a number of teaching devices including demonstrations, lectures, leaflets, and exhibits. These have been successful in many situations, but the development of supervised educational methods by the Farmers Home Administration and by private contracting firms now seems even more effective for certain situations.

Procedure: Initial exploratory analysis should be directed to careful analysis of a number of historical examples in order to identify the kinds of situations in which supervised education is most advantageous. Thought needs to be given to the kinds of factors involved in

obtaining rapid rates of adoption of specific new techniques. How much is a learning process, how much is attributable to other factors? Perhaps a farmer is convinced but lacks the capital, or is unwilling to take a risk.

Studies of Methods of Improving Vertical Coordination

Granted that various kinds of vertical coordination will be used, we need to try to make each work as well as possible. The projects outlined in this section differ considerably in scope and aim, but they have in common the objective of improving practical operations under contract farming and other kinds of vertical coordination. One proposal suggests the development of model economic provisions for contracts in order to accomplish the intended purposes as efficiently as possible. Another examines alternative financing methods, and others develop the economies of centralization and of expanding or contracting the number of stages included in the farm firm.

Project 10.—Developing Desirable Economic Provisions in Production Contracts

Objective: To develop model contracts or model contract provisions for use with specific farm commodities and situations in contract farming.

Discussion: Many economic questions arise in connection with contract provisions not only as between the two parties to the contract but with respect to equity between producers. For example, should poultry and livestock contracts provide for distance differentials to reflect differences between producers in costs of hauling feed or finished products? What effect will such differentials have on returns to producers and on location of production?

Procedure: Select a commodity situation, examine representative contracts, and list the provisions, present or absent, that appear to deal with significant economic questions. Legal questions may also be involved, and at some point the two will need to be brought together. But the first job in this study is to work out the economic problems, estimate their relative importance, and design contract provisions for dealing with them.

The end result would appear as a model contract (or several alternative model contracts) for the commodity situation in question.

Project 11.—Improving Alternative Methods of Financing Short Term Investment in Agricultural Production

Objective: To compare the economic efficiency of alternative methods of financing broiler (or other livestock) production and to suggest improvements.

Discussion: Under contracting and vertical integration, nonfarm businesses have provided much operating capital to agriculture in the form of chicks, feed, and other supplies. The major question is whether nonfarm firms extract too high a return for this investment. And can financing be obtained from other sources more efficiently? It is recognized that integrators assume more functions than that of financing. They provide markets, assume certain production risks, and furnish management and new technology. Is it possible for agriculture to get credit more efficiently from the banking and credit system and rearrange the incidence of the functions other than credit? Perhaps the farmer and the credit supplier can assume more of the risk and management.

Some changes in financing may come in the natural course of events as technology and good management practices become more widely known, as farms expand in size,

and as marketing becomes more stabilized. Avenues that might be explored include: supervised production loans, special lender reserves for losses, and contractor guaranteed loans, cooperative production and financing, some form of price and income insurance, and governmental price supports.

Procedure: Through existing data or new investigations, the initial step might uncover charges or deductions for contractors and allocate them between capital supplied and other functions assumed, such as risk and management. The cost of capital could be compared with costs of borrowing and obtaining supplies in the open market. Comparisons might also be made between the charge for risk and management and the cost of spreading risk or securing needed management in other ways. Situations would vary depending upon the size of operations, the capital position and managerial ability of different producers, upon the product market, and the credit market.

Several possible models that would meet the problem could be constructed and their comparative application to particular situations worked out.

Project 12.—The Economics of Vertical Expansion or Contraction in Farm Firms

Objective: To determine the number of vertical stages of production or marketing to include in a farm business to yield the most advantageous results to the farmer.

Discussion: The problem is not unlike the familiar one of choosing the most profitable combination of enterprises. In this instance the vertical stages take the place of enterprises that can be included or excluded from the farm structure. Examples of input stages that farmers might integrate into the business or exclude and buy from other firms are producing feed, combining grain, harvesting hay, grinding and

mixing grain, spreading lime and fertilizer, and producing young dairy stock. Examples of later stages that could be included in the farm firm or handled by separate forward firms are fattening live-stock, grading and packing eggs, and retailing vegetables. One important factor determining stages to be included or excluded is whether they can be operated at minimum-optimum scale efficiency. Some thought should be given also to the question of economic uncertainty.

Procedure: Select one or more area and commodity situations representative of the problems, construct a representative budget for each situation desired, and carry out the analyses needed for the stages involved. Three types of situations may be considered:

- (1) Change in the number of stages, and in their scale of operation with level of technology and efficiency remaining the same;
- (2) Change in the number of stages, and in scale, with improved levels of technology and efficiency; and
- (3) Present combination of stages with efficiency improved through other means.

Project 13.—Relative Economy of Various Degrees of Vertical Integration in Mixing Hog Feed for Use on Corn-Hog Farms (and similarly for other livestock feeds)

Objective: To determine relative costs and effectiveness of various alternative ways of preparing hog feeds.

Discussion: One of the important factors in the extent to which hog production may become vertically integrated relates to the extent to which the integration of feed preparation may be carried out. As multiple farrowing and year-round hog production become common, the use of complete hog feeds will doubtless increase, but

how and where shall these hog feeds be prepared? Completely on the farm, completely in the feed mill, partly in each, or what? The use of small-scale home mixing equipment, portable feed mills, feed banks, and various other devices needs to be examined.

Procedure: Set up several specific alternatives that seem to best represent feasible possibilities for existing or potential scales of operation.

Obtain data from existing studies or from new field studies that will permit calculation of costs for each method and also estimation of effectiveness in use. Some programs will probably fit better in specific situations. These situations need to be identified.

Project 14.—Centralization and Dispersion in Livestock Feeding as Factors in Vertical Coordination

Objective: To determine the combination of the central processing volume for feed and for livestock and the surrounding production density that will result in the lowest total unit cost for the supply area and commodity in question.

Discussion: This is a matter of middle distance and long-run economic organization for a supply area. Henry and Seagraves (31) have pioneered in this type of study with respect to broilers in an area in North Carolina. Such a study may tend to overemphasize location and transportation factors unless special effort is given to analyzing all production costs. This includes not only analysis of economies of scale for processing plants but for farm feeding operations as well.

Procedure: The analysis needed involves the construction of cost curves for different levels of operation for each of the major stages involved—feed processing, growing and feeding, and product processing. Because the area organization sought is a future organization, the analysis ends in a synthesis

combining the various stages most economically. This involves harmonizing operations in different stages to obtain the overall least-cost scale of operation for all stages combined.

Studies of Supply Management and Vertical Coordination

Supply management implies the use of more governmental power or assistance in the management of output to prevent excessive production. Because of the probable influence of contracting and vertical integration on speeding up production in the broiler industry, for example, some attention needs to be directed to this problem. Also, any program that might be developed would need to take account of the kinds of vertical coordination present in the industry. In the instance of sugar beets, a very intricate set of interrelationships exists between the grower-processor contract program and the Government's sugar program. A different but equally complex structure has been developed to deal with fluid milk and dairy products.

Project 15.—Supply Management and Vertical Integration in Poultry Production

Objective: To develop and appraise the feasibility of alternative structural programs of supply management for poultry products.

Discussion: Successive periods of prolonged price distress in broilers and turkeys are more serious than formerly. The 1961 phase of mass expansion in output and extremely low grower prices brought a number of proposals for some means of eliminating or at least alleviating the considerable economic and social waste that accompanies such episodes.

Particular forms of coordination are not the basic causes of the situation but like other kinds of innovation, new forms of structural tech-

nology may contribute to rapidity of growth of an industry and add to the difficulties of adjustment likely to accompany expansion. The problem is how to use forms of vertical coordination to greater advantage.

Procedure: Identify and describe structural forms of supply management that may offer promise in specific problem situations. These will include: (1) marketing orders and

agreements applied at various vertical points in the industry, (2) rationing of inputs of chicks and feeds, (3) output quotas, and (4) more integration between some stages and less between others.

Analysis would attempt to estimate the probable effects of each specified type of program in terms of achieving the objectives sought and in terms of other costs and effects.

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